Installation, Start-up and Service Instructions

CONTENTS

SAFETY CONSIDERATIONS

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could cause in personal injury or death.

Before performing service or maintenance operations on unit, always turn off main power switch to unit and install lockout tag. Unit may have more than one power switch.

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the

literature, tags and labels attached to the unit, and other safety precautions that may apply.

Follow all local building codes and appropriate national electrical codes (in USA, ANSI/NFPA 70, National Electrical Code (NEC); in Canada, CSA C22.1) for special requirements. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguisher available for all brazing operations.

It is important to recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, CAUTION, and NOTE. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices, which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

⚠ WARNING

UNIT OPERATION AND SAFETY HAZARD

Failure to follow this warning could cause personal injury, death and/or equipment damage.

R-410A refrigerant systems operate at higher pressures than standard R-22 systems. Do not use R-22 service equipment or components on R-410A refrigerant equipment.

⚠ WARNING

PERSONAL INJURY AND ENVIRONMENTAL HAZARD

Failure to follow this warning could cause personal injury or death.

Relieve pressure and recover all refrigerant before system repair or final unit disposal.

Wear safety glasses and gloves when handling refrigerants. Keep torches and other ignition sources away from refrigerants and oils.

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts and servicing 40RU units.

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution could cause equipment damage.

Ensure voltage listed on unit data plate agrees with electrical supply provided for the unit.

PRE-INSTALLATION

1. The power supply (v, ph, and Hz) must correspond to that specified on unit rating plate.
2. The electrical supply provided by the utility must be sufficient to handle load imposed by this unit.
3. Refer to Installation, General section (page 2) and Fig. 1 and Fig. 2 for locations of electrical inlets, condensate drain, duct connections, and required clearances before setting unit in place.
4. This installation must conform with local building codes and with the NEC (National Electrical Code) or ANSI (American National Standards Institute)/NFPA (National Fire Protection Association) latest revision. Refer to provincial and local plumbing or wastewater codes and other applicable local codes.

Moving and Storage

To transfer unit from truck to storage site, use a fork truck. Do not stack units more than 2 high during storage. If unit is to be stored for more than 2 weeks before installation, choose a level, dry storage site free from vibration. Do not remove plastic wrap or skid from unit until final installation.

Rigging

All 40RU Series units can be rigged by using the shipping skid. Units are shipped fully assembled. Do not remove shipping skids or protective covering until unit is ready for final placement; damage to bottom panels can result. Use slings and spreader bars as applicable to lift unit.

INSTALLATION

General

Allow the following clearances for service access and airflow:

- Rear: 2-1/2 ft (762 mm) [2-1/2 ft (762 mm) with electric heat accessory]
- Front: 2-1/2 ft (762 mm)
- Right Side: 3-1/2 ft (1067 mm)
- Left Side: 2-1/2 ft (762 mm)

For units equipped with an economizer, refer to the accessory installation instructions for additional clearance requirements. Be sure floor, wall, or ceiling can support unit weight (Tables 1-6). See Fig. 1 and Fig. 2 for dimensions.

Uncrating

Move unit as near as possible to final location before removing shipping skid.

Remove metal banding, top skid, and plastic wrap. Examine unit for shipping damage. If shipping damage is evident, file claim with transportation agency. Remove base skid just prior to actual installation.

Check nameplate information against available power supply and model number description in Fig. 3 and 4.

NOTE: Be sure to remove the Styrofoam™[1] shipping pad from the thermostatic expansion valve (TXV). Verify that it has been removed. (See Fig. 5.)

Accessories

Refer to instructions shipped with each accessory for specific information.

1. Third-party trademarks and logos are the property of their respective owners.

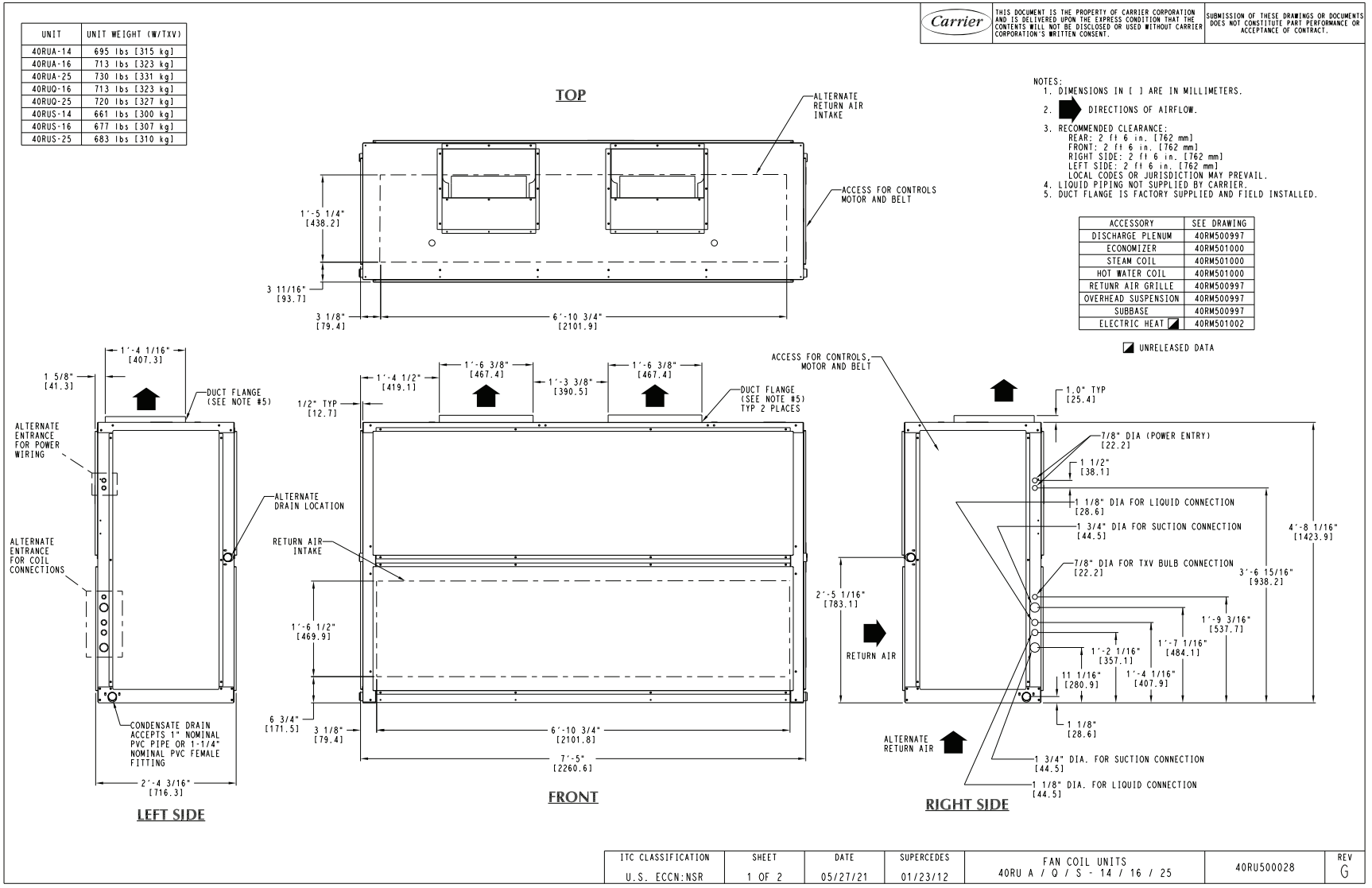
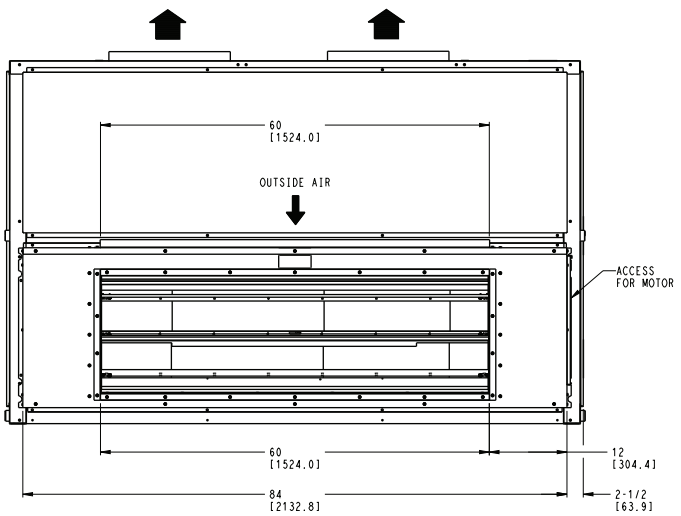
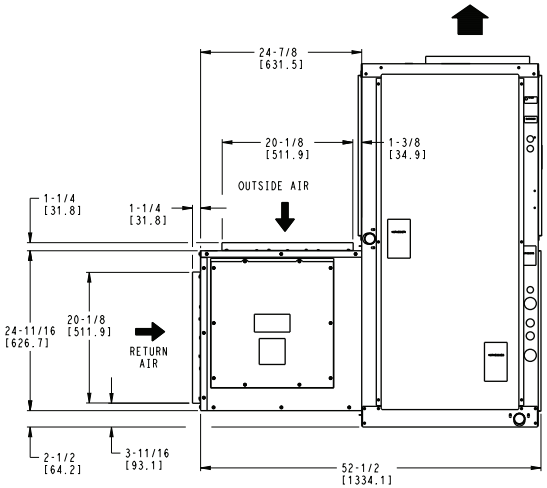


Fig. 1 — Dimensions — Size 25



FRONT



RIGHT SIDE

UNIT WITH ECONOMIZER

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	2 OF 2	05/27/21	01/23/12	FAN COIL UNITS 40RU A / Q / S - 14 / 16 / 25	40RU500028	G

Fig. 1 — Dimensions — Size 25 (cont)

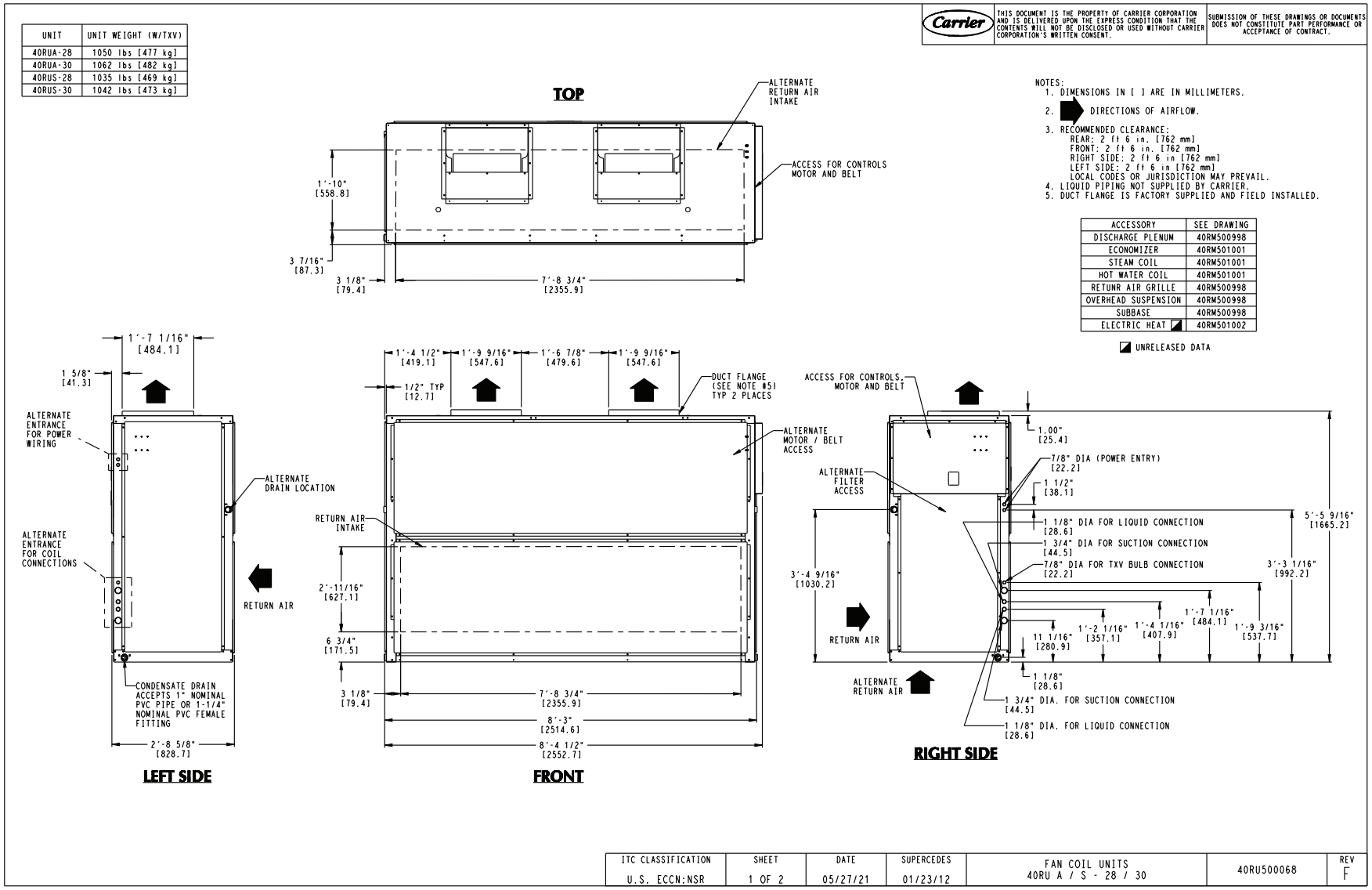
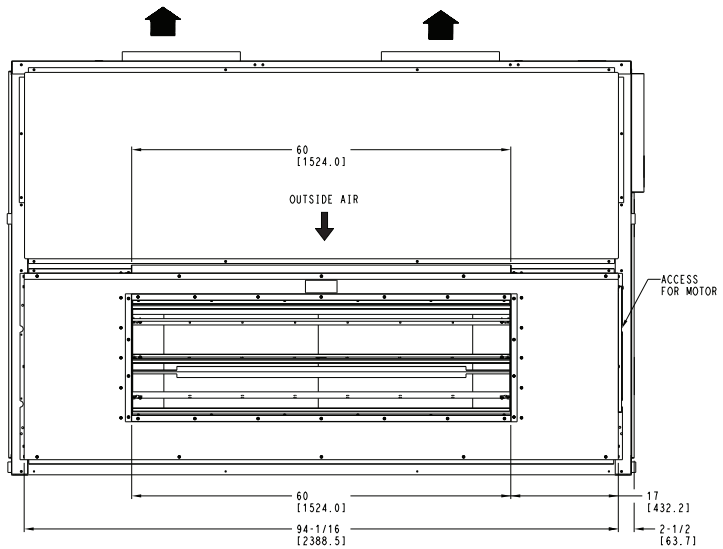


Fig. 2 — Dimensions — Sizes 28 and 30



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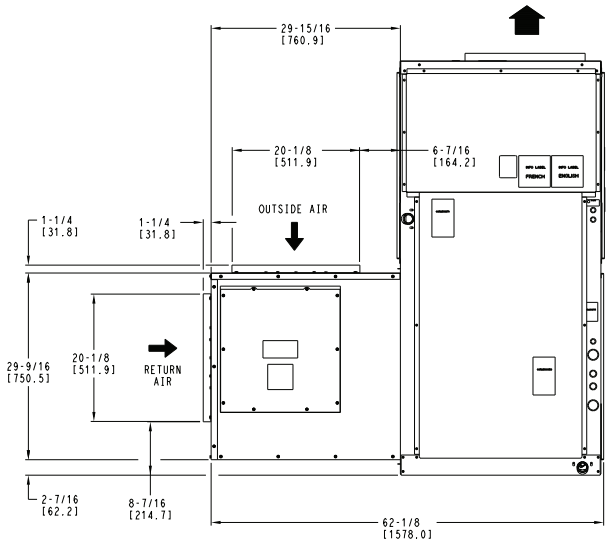


RIGHT SIDE

UNIT WITH ECONOMIZER

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	2 OF 2	05/27/21	01/23/12	FAN COIL UNITS 40RU A / S - 28 / 30	40RU500068	F

Fig. 2 — Dimensions — Sizes 28 and 30 (cont)

Table 1 — 40 RUA Physical Data, English — Cooling Units

UNIT 40RUA*	25	28	30
NOMINAL CAPACITY (Tons)	20	25	30
OPERATING WEIGHT (lb)			
Base Unit with TXV	730	1050	1062
Plenum	225	325	325
FANS			
Qty...Diam. (in.)	2...15	2...18	2...18
Nominal Airflow (cfm)	8,000	10,000	12,000
Airflow Range (cfm)	6,000-10,000	7,500-12,500	9,000-15,000
Nominal Motor Hp (Standard Motor)			
208/230-60 and 460-3-60	5.0	7.5	10.0
575-3-60	5.0	7.5	10.0
Motor Speed (rpm)			
208/230-3-60 and 460-3-60	1760	1760	1755
575-3-60	1745	1755	1755
REFRIGERANT	R-410A	R-410A	R-410A
Operating Charge (lb) (approx per circuit)[a]	3.5	4.5	5.0
DIRECT — EXPANSION COIL	Enhanced Copper Tubes, Aluminum Sine-Wave Fins		
Maximum Working Pressure (psig)	650	650	650
Face Area (sq ft)	19.88	24.86	29.83
No. of Splits	2	2	2
No. of Circuits per Split	18	20	24
Split Type...Percentage	Face...50/50	Face...50/50	Face...50/50
Rows...Fins/in.	4...15	4...15	4...15
PIPING CONNECTIONS			
Quantity...Size (in.)			
DX Coil — Suction (ODF)	2...1-1/8	2...1-3/8	2...1-3/8
DX Coil — Liquid Refrigerant (ODF)	2...5/8	2...5/8	2...5/8
Steam Coil, In (MPT)	1...2-1/2	1...2-1/2	1...2-1/2
Steam Coil, Out (MPT)	1...1-1/2	1...1-1/2	1...1-1/2
Hot Water Coil, In (MPT)	1...2	1...2	1...2
Hot Water Coil, Out (MPT)	1...2	1...2	1...2
Condensate (PVC)	1...5/8 ODM/1-1/4 IDF	1...5/8 ODM/1-1/4 IDF	1...5/8 ODM/1-1/4 IDF
FILTERS	Throwaway — Factory Supplied	Throwaway — Factory Supplied	Throwaway — Factory Supplied
Quantity...Size (in.)	4...16 x 20 x 2 4...16 x 24 x 2	4...20 x 24 x 2 4...20 x 25 x 2	4...20 x 24 x 2 4...20 x 25 x 2
Access Location	Either Side	Either Side	Either Side
STEAM COIL[b]			
Maximum Working Pressure (psig at 260°F)	20	20	20
Total Face Area (sq ft)	13.33	15.0	15.0
Rows...Fins/in.	1...10	1...10	1...10
HOT WATER COIL[b]			
Maximum Working Pressure (psig)	150	150	150
Total Face Area (sq ft)	13.33	15.0	15.0
Rows...Fins/in.	2...8.5	2...12.5	2...12.5
Water Volume			
(gal)	13.9	14.3	14.3
(ft^3)	1.85	1.90	1.90

NOTE(S):

a. Units are shipped without refrigerant charge.
b. Field-installed accessory only.

LEGEND

DX — Direct Expansion
IDF — Inside Diameter, Female
ODF — Outside Diameter, Female
ODM — Outside Diameter, Male
TXV — Thermostatic Expansion Valve

Table 2 — 40 RUA Physical Data, SI — Cooling Units

UNIT 40RUA*	25	28	30
NOMINAL CAPACITY (kW)	70	87	105
OPERATING WEIGHT (kg)			
Base Unit with TXV	331	477	482
Plenum	102	148	148
FANS			
Qty...Diam. (mm)	2...381	2...457	2...457
Nominal Airflow (L/s)	3775	4119	5663
Airflow Range (L/s)	2831-4719	3539-5899	4247-7079
Nominal Motor kW (Standard Motor)			
208/230-3-60 and 460-3-60	3.73	5.60	7.46
575-3-60	3.73	5.60	7.46
Motor Speed (r/s)			
208/230-3-60 and 460-3-60	29.3	29.3	29.3
575-3-60	29.1	29.3	29.3
REFRIGERANT	R-410A	R-410A	R-410A
Operating Charge (kg) (approx per circuit)[a]	1.59	2.04	2.27
DIRECT — EXPANSION COIL	Enhanced Copper Tubes, Aluminum Sine-Wave Fins		
Maximum Working Pressure (kPag)	4481	4481	4481
Face Area (sq m)	1.85	2.30	2.77
No. of Splits	2	2	2
No. of Circuits per Split	18	20	24
Split Type...Percentage	Face...50/50	Face...50/50	Face...50/50
Rows...Fins/m	4...591	4...591	4...591
PIPING CONNECTIONS			
Quantity...Size (in.)			
DX Coil — Suction (ODF)	2...1-1/8	2...1-3/8	2...1-3/8
DX Coil — Liquid Refrigerant (ODF)	2...5/8	2...5/8	2...5/8
Steam Coil, In (MPT)	1...2-1/2	1...2-1/2	1...2-1/2
Steam Coil, Out (MPT)	1...1-1/2	1...1-1/2	1...1-1/2
Hot Water Coil, In (MPT)	1...2	1...2	1...2
Hot Water Coil, Out (MPT)	1...2	1...2	1...2
Condensate (PVC)	1...5/8 ODM/1-1/4 IDF	1...5/8 ODM/1-1/4 IDF	1...5/8 ODM/1-1/4 IDF
FILTERS	Throwaway — Factory Supplied	Throwaway — Factory Supplied	Throwaway — Factory Supplied
Quantity...Size (mm)	4... 406 x 508 x 51 4...406 x 610 x 51	4...508 x 610 x 51 4...508 x 635 x 51	4...508 x 610 x 51 4...508 x 635 x 51
Access Location	Either Side	Either Side	Either Side
STEAM COIL[b]			
Maximum Working Pressure (kPag at 126°C)	138	138	138
Total Face Area (sq m)	1.24	1.39	1.39
Rows...Fins/m	1...394	1...394	1...394
HOT WATER COIL[b]			
Maximum Working Pressure (kPag)	1034	1034	1034
Total Face Area (sq ft)	1.24	1.39	1.39
Rows...Fins/in.	2...335	2...335	2...335
Water Volume			
(L)	52.6	54.1	54.1
(m^3)	0.052	0.054	0.054

NOTE(S):

a. Units are shipped without refrigerant charge.
b. Field-installed accessory only.

LEGEND

DX — Direct Expansion
IDF — Inside Diameter, Female
ODF — Outside Diameter, Female
ODM — Outside Diameter, Male
TXV — Thermostatic Expansion Valve

Table 3 — 40RUQ Physical Data, English — Heat Pump Units

UNIT 40RUQ*	25
NOMINAL CAPACITY (Tons)	20
OPERATING WEIGHT (lb)	
Base Unit with TXV	720
Plenum	225
FANS	
Qty...Diam. (in.)	2...15
Nominal Airflow (cfm)	8,000
Airflow Range (cfm)	6,000-10,000
Nominal Motor kW (Standard Motor)	
208/230-3-60 and 460-3-60	5.0
575-3-60	5.0
Motor Speed (rpm)	
208/230-3-60 and 460-3-60	1760
575-3-60	1745
REFRIGERANT	R-410A
Operating Charge (lb) (approx per circuit)[a]	3.5/3.5
DIRECT — EXPANSION COIL	Enhanced Copper Tubes, Aluminum Sine-Wave Fins
Maximum Working Pressure (psig)	650
Face Area (sq ft)	19.9
No. of Splits	2
No. of Circuits per Split	10
Split Type...Percentage	Face....50/50
Rows...Fins/in.	4...15
PIPING CONNECTIONS	
Quantity...Size (in.)	
DX Coil — Suction (ODF)	2...1-1/8
DX Coil — Liquid Refrigerant (ODF)	2...5/8
Steam Coil, In (MPT)	1...2-1/2
Steam Coil, Out (MPT)	1...1-1/2
Hot Water Coil, In (MPT)	1...2
Hot Water Coil, Out (MPT)	1...2
Condensate (PVC)	1...1-1/4 ODM/1 IDF
FILTERS	Throwaway — Factory Supplied
Quantity...Size (in.)	4...16 x 20 x 2
	4...16 x 24 x 2
Access Location	Right or Left Side
STEAM COIL[b]	
Maximum Working Pressure (psig at 260°F)	20
Total Face Area (sq ft)	13.33
Rows...Fins/in.	1...10
HOT WATER COIL[b]	
Maximum Working Pressure (psig)	150
Total Face Area (sq ft)	13.33
Rows...Fins/in.	2...8.5
Water Volume	
(gal)	13.9
(ft^3)	1.85

NOTE(S):

a. Units are shipped without refrigerant charge.
b. Field-installed accessory only.

LEGEND

DX — Direct Expansion
IDF — Inside Diameter, Female
ODF — Outside Diameter, Female
ODM — Outside Diameter, Male
TXV — Thermostatic Expansion Valve

Table 4 — 40RUQ Physical Data, SI — Heat Pump Units

UNIT 40RUQ*	25
NOMINAL CAPACITY (kW)	70
OPERATING WEIGHT (kg)	
Base Unit with TXV	327
Plenum	44
FANS	
Qty...Diam. (mm)	2...381
Nominal Airflow (L/s)	3775
Airflow Range (L/s)	2831-4719
Nominal Motor kW (Standard Motor)	
208/230-3-60 and 460-3-60	3.73
575-3-60	3.73
Motor Speed (r/s)	
208/230-3-60 and 460-3-60	29.3
575-3-60	29.1
REFRIGERANT	R-410A
Operating Charge (kg) (approx per circuit)[a]	1.59 /1.59
DIRECT — EXPANSION COIL	Enhanced Copper Tubes, Aluminum Sine-Wave Fins
Maximum Working Pressure (kPag)	4482
Face Area (sq m)	1.85
No. of Splits	2
No. of Circuits per Split	2
Split Type...Percentage	Face...50/50
Rows...Fins/m	591
PIPING CONNECTIONS	
Quantity...Size (in.)	
DX Coil — Suction (ODF)	2...1-1/8
DX Coil — Liquid Refrigerant (ODF)	2...5/8
Steam Coil, In (MPT)	1...2-1/2
Steam Coil, Out (MPT)	1...1-1/2
Hot Water Coil, In (MPT)	1...2
Hot Water Coil, Out (MPT)	1...2
Condensate (PVC)	1...1-1/4 ODM/1 IDF
FILTERS	Throwaway — Factory Supplied
Quantity...Size (mm)	4... 406 x 508 x 51 4...406 x 610 x 51
Access Location	Right or Left Side
STEAM COIL[b]	
Maximum Working Pressure (kPag at 126°C)	138
Total Face Area (sq m)	1.24
Rows...Fins/m	1...394
HOT WATER COIL[b]	
Maximum Working Pressure (kPag)	1034
Total Face Area (sq ft)	1.24
Rows...Fins/in.	2...335
Water Volume	
(L)	52.6
(m^3)	0.052

NOTE(S):

a. Units are shipped without refrigerant charge.
b. Field-installed accessory only.

LEGEND

DX — Direct Expansion
IDF — Inside Diameter, Female
ODF — Outside Diameter, Female
ODM — Outside Diameter, Male
TXV — Thermostatic Expansion Valve

Table 5 — 40RUS Physical Data, English — Chilled Water Unit

UNIT 40RUS*	25	28	30
NOMINAL CAPACITY (Tons)	20	25	30
OPERATING WEIGHT (lb)			
Base Unit	683	1035	1042
Plenum	225	325	325
FANS			
Qty...Diam. (in.)	2...15	2...18	2...18
Nominal Airflow (cfm)	8,000	10,000	12,000
Airflow Range (cfm)	6,000-10,000	7,500-12,500	9,000-15,000
Nominal Motor Hp (Standard Motor)			
208/230-3-60 and 460-3-60	5.0	7.5	10.0
575-3-60	5.0	7.5	10.0
Motor Speed (rpm)			
208/230-3-60 and 460-3-60	1745	1745	1745
575-3-60	1745	1755	1755
CHILLED WATER COIL	Enhanced Copper Tubes, Aluminum Sine-Wave Fins		
Maximum Working Pressure (psig)	435	435	435
Face Area (sq ft) — Upper	11.0	12.4	15.5
Face Area (sq ft) — Lower	8.3	12.4	12.4
Rows...Fins/in.	3...15	3...15	3...15
PIPING CONNECTIONS			
Quantity...Size (in.)			
Chilled Water — In	2...1-3/8 ODM	2...2-1/8 ODM	2...2-1/8 ODM
Chilled Water — Out	2...1-3/8 ODM	2...2-1/8 ODM	2...2-1/8 ODM
Steam Coil, In (MPT)	1...2-1/2	1...2-1/2	1...2-1/2
Steam Coil, Out (MPT)	1...1-1/2	1...1-1/2	1...1-1/2
Hot Water Coil, In (MPT)	1...2	1...2	1...2
Hot Water Coil, Out (MPT)	1...2	1...2	1...2
Condensate (PVC)	1...5/8 ODM/1-1/4 IDF	1...5/8 ODM/1-1/4 IDF	1...5/8 ODM/1-1/4 IDF
FILTERS	Throwaway — Factory Supplied	Throwaway — Factory Supplied	Throwaway — Factory Supplied
Quantity...Size (in.)	4...16 x 20 x 2 4...16 x 24 x 2	4...20 x 24 x 2 4...20 x 25 x 2	4...20 x 24 x 2 4...20 x 25 x 2
Access Location	Either Side	Either Side	Either Side
STEAM COIL[a]			
Maximum Working Pressure (psig at 260°F)	20	20	20
Total Face Area (sq ft)	13.33	15.0	15.0
Rows...Fins/in.	1...10	1...10	1...10
HOT WATER COIL[a]			
Maximum Working Pressure (psig)	150	150	150
Total Face Area (sq ft)	13.33	15.0	15.0
Rows...Fins/in.	2...8.5	2...12.5	2...12.5
Water Volume			
(gal)	13.9	14.3	14.3
(ft^3)	1.85	1.90	1.90

NOTE(S):

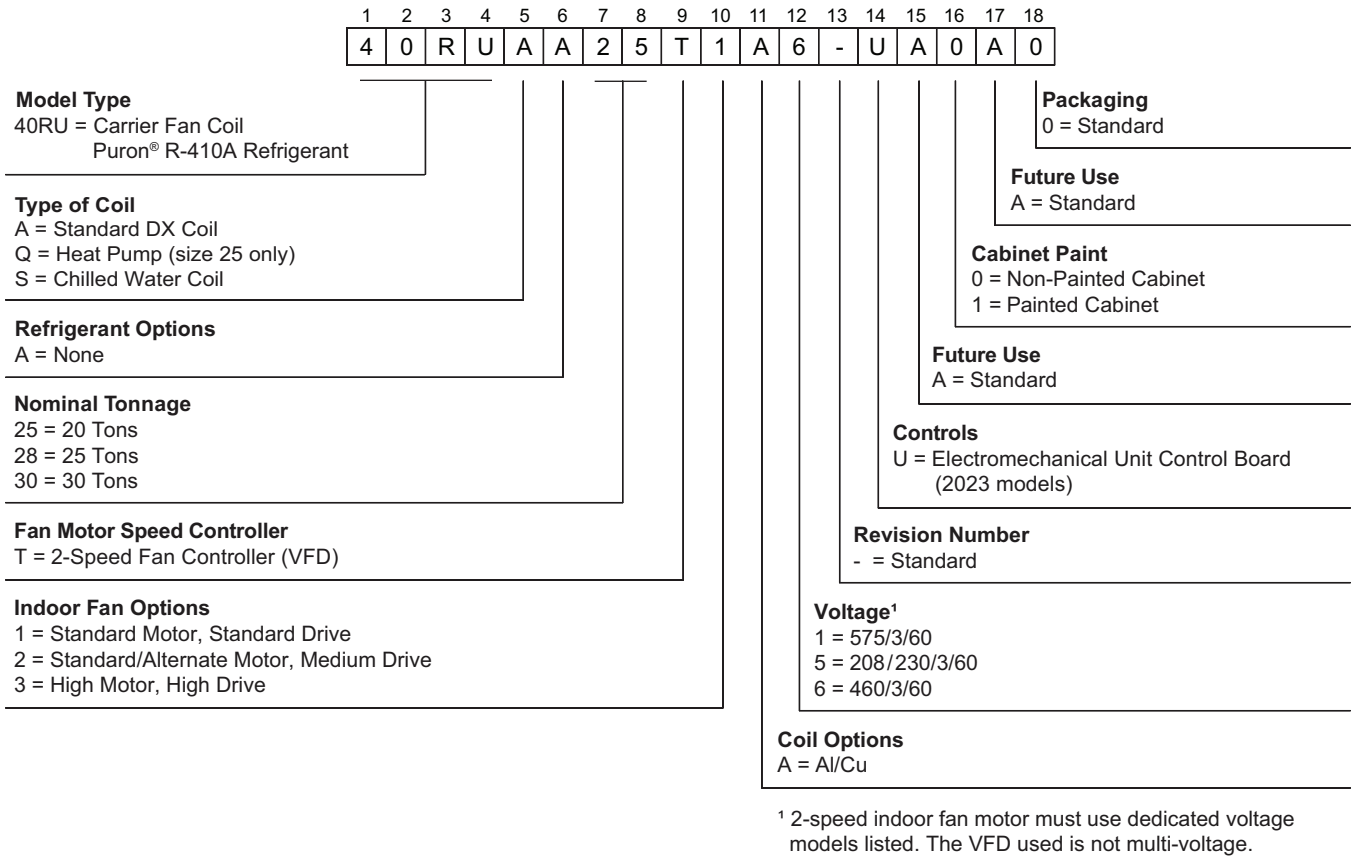
a. Field-installed accessory only.

Table 6 — 40RUS Physical Data, SI — Chilled Water Units

UNIT 40RUS*	25	28	30
NOMINAL CAPACITY (kW)	70	87	105
OPERATING WEIGHT (kg)			
Base Unit with TXV	310	469	473
Plenum	102	148	148
FANS			
Qty...Diam. (mm)	2...381	2...457	2...457
Nominal Airflow (L/s)	3775	4719	5663
Airflow Range (L/s)	2831-4719	3539-5899	4247-7079
Nominal Motor kW (Standard Motor)			
208/230-3-60 and 460-3-60	3.73	5.60	7.46
575-3-60	3.73	5.60	7.46
Motor Speed (r/s)			
208/230-3-60 and 460-3-60	29.1	29.1	29.1
575-3-60	29.1	29.3	29.3
CHILLED WATER COIL	Enhanced Copper Tubes, Aluminum Sine-Wave Fins		
Maximum Working Pressure (kPag)	2999	2999	2999
Face Area (sq m) — Upper	1.02	1.15	1.44
Face Area (sq m) — Lower	0.77	1.15	1.15
Rows...Fins/m	3...591	3...591	3...591
PIPING CONNECTIONS			
Quantity...Size (in.)			
Chilled Water — In	2...1-3/8 ODM	2...2-1/8 ODM	2...2-1/8 ODM
Chilled Water — Out	2...1-3/8ODM	2...2-1/8 ODM	2...2-1/8 ODM
Steam Coil, In (MPT)	1...2-1/2	1...2-1/2	1...2-1/2
Steam Coil, Out (MPT)	1...1-1/2	1...1-1/2	1...1-1/2
Hot Water Coil, In (MPT)	1...2	1...2	1...2
Hot Water Coil, Out (MPT)	1...2	1...2	1...2
Condensate (PVC)	1...5/8 ODM/1-1/4 IDF	1...5/8 ODM/1-1/4 IDF	1...5/8 ODM/1-1/4 IDF
FILTERS	Throwaway — Factory Supplied	Throwaway — Factory Supplied	Throwaway — Factory Supplied
Quantity...Size (mm)	4... 406 x 508 x 51 4...406 x 610 x 51	4...508 x 610 x 51 4...508 x 635 x 51	4...508 x 610 x 51 4...508 x 635 x 51
Access Location	Either Side	Either Side	Either Side
STEAM COIL[a]			
Maximum Working Pressure (kPag at 125°C)	138	138	138
Total Face Area (sq m)	1.24	1.39	1.39
Rows...Fins/m	1...394	1...394	1...394
HOT WATER COIL[a]			
Maximum Working Pressure (kPag)	1034	1034	1034
Total Face Area (sq m)	1.24	1.39	1.39
Rows...Fins/m	2...335	2...493	2...493
Water Volume			
(L)	52.6	54.1	54.1
(m^3)	0.052	0.054	0.054

NOTE(S):

a. Field-installed accessory only.



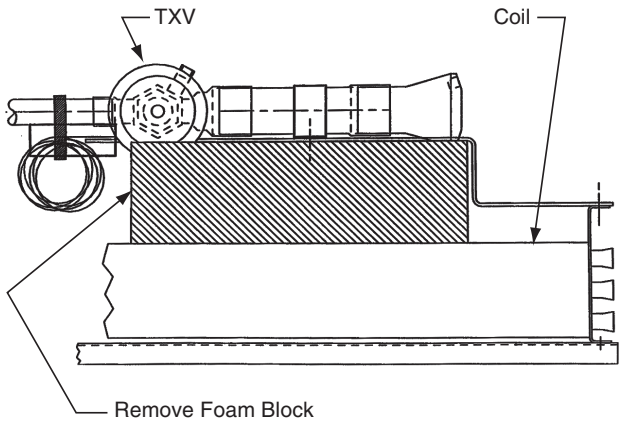
[1] 2-speed indoor fan motor must use dedicated voltage models listed. The VFD used is not multi-voltage.

Fig. 3 — Model Number Nomenclature

POSITION NUMBER	1	2	3	4	5	6	7	8	9	10
TYPICAL	2	6	2	3	G	1	2	3	4	5

POSITION	DESIGNATES
1−2	Week of manufacture (fiscal calendar)
3−4	Year of manufacture (“23” = 2023)
5	Manufacturing location
6−10	Sequential number

Fig. 4 — Serial Number Nomenclature



LEGEND
TXV — Thermostatic Expansion Valve

Fig. 5 — Foam Block Location

Unit Positioning

The unit can be mounted on the floor for vertical application with return air entering the face of the unit and supply air discharging vertically through the top of the unit. The unit can also be applied in a horizontal arrangement with return air entering horizontally and the supply air discharging horizontally. When applying the unit in a horizontal arrangement, ensure the condensate drain pan is located at the bottom center of the unit for adequate condensate disposal. See Fig. 6 for condensate connections for each unit position.

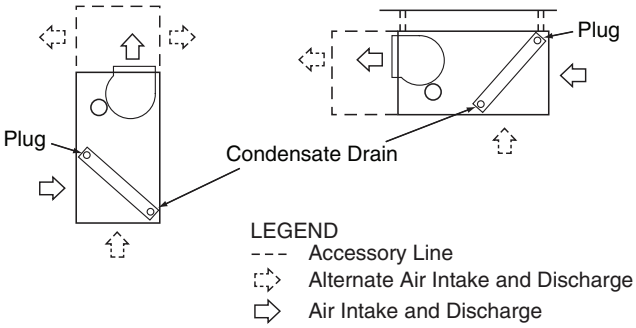


Fig. 6 — Typical Unit Positioning

Typical positioning and alternate return air locations are shown in Fig. 6. Alternate return air locations can be used by moving the unit panel from the alternate return air location to the standard return air location. Refer to overhead suspension accessory drawing. (See Fig. 7.) for preferred suspension technique. The unit needs support underneath to prevent sagging.

IMPORTANT: Do NOT attempt to install unit with return air entering top panel of unit. Condensate will not drain from unit.

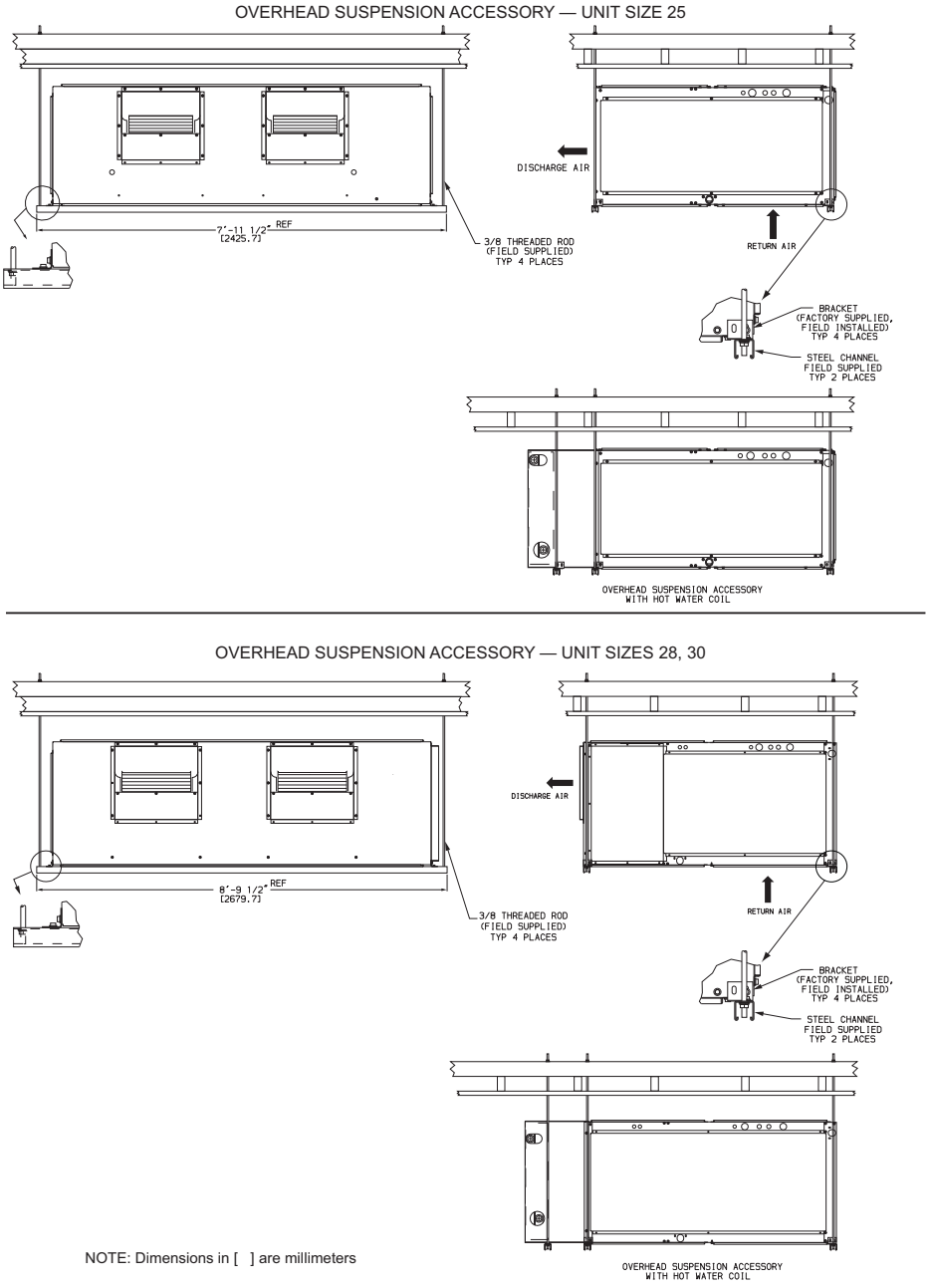


Fig. 7 — Preferred Suspension Technique

Unit Isolation

Where extremely quiet operation is essential, install isolators between floor and base of unit, or between ceiling and top section of unit.

Be sure that unit is level and adequately supported. Use channels at front and sides of unit for reference points when leveling.

Refrigerant and Chilled Water Piping Access

The 40RU Series units come with standard knockouts for refrigerant and chilled water piping. These knockouts are located on both sides of the unit for installation flexibility. The standard knockouts provide sufficient access to the unit's coils for all 40RUA*25, 28, and 30 units. 40RUQ*25 units, as well as 40RUS*25, 28, and 30 units require additional holes which must be field-fabricated to accommodate the piping. See Fig. 8 for the positions and dimensions of the additional access holes required for 40RUQ and 40RUS units. Recommended access hole use is also listed for all units. Note that Fig. 8 shows the access holes on the control-box side of the unit; this is the side of the unit with the coil headers, which is used most often for piping access.

IMPORTANT: Do not bury refrigerant piping underground.

Refrigerant Piping

See Tables 1-6 for refrigerant pipe connection sizes. For ease in brazing, it is recommended that all internal solder joints be made before unit is placed in final position.

The 40RU direct-expansion units have internal factory-installed thermostatic expansion valves (TXVs), distributors, and nozzles for use with R-410A. See Table 7 for part numbers. Knockouts are provided in the unit corner posts for 40RU refrigerant piping. See Fig. 8, which also lists recommended knockouts and access holes to use for each 40RU unit size. Recommended fittings are listed in Table 8.

The sensor bulb capillary tubes must be routed from the TXVs inside the unit through one of the piping access holes. Clamp the TXV sensor bulb on a vertical portion of the suction line, outside the unit. (See Fig. 9.)

NOTE: Be sure to remove the Styrofoam™ [1] shipping pad from the TXV. Verify that it has been removed. (See Fig. 5.)

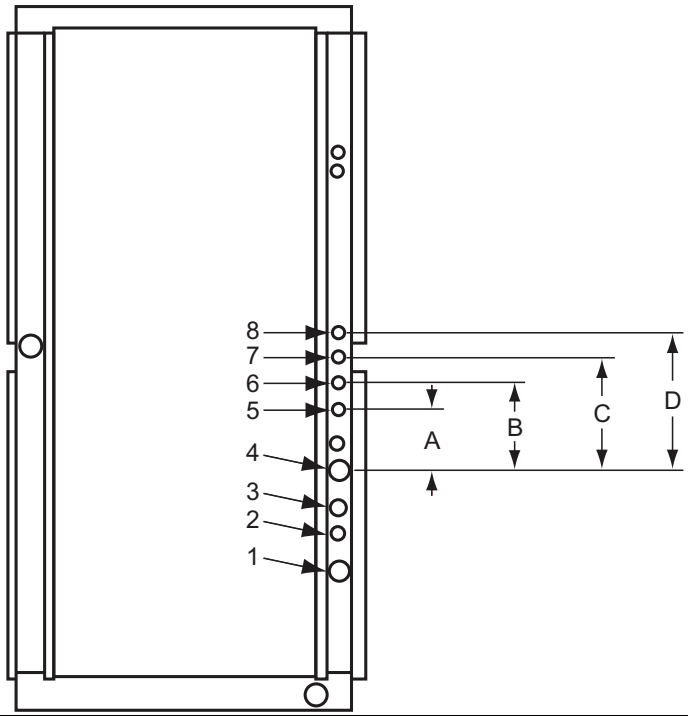
IMPORTANT: Never attach the sensor to the suction manifold. Do NOT mount the sensor on a trapped portion of the suction line.

The 40RU Series evaporator coils have a face-split design. Ensure that lower circuit of coil is first on/last off when connected to the condensing unit and/or system controls. (See Fig. 10.)

External TXV equalizer connections are provided and factory-brazed into the coil suction manifolds.

If suction line must be horizontal, clamp bulb to suction line at least 45 degrees above bottom, at approximately the 4 o'clock or 8 o'clock position. (See Fig. 11.)

1. Third-party trademarks and logos are the property of their respective owners.

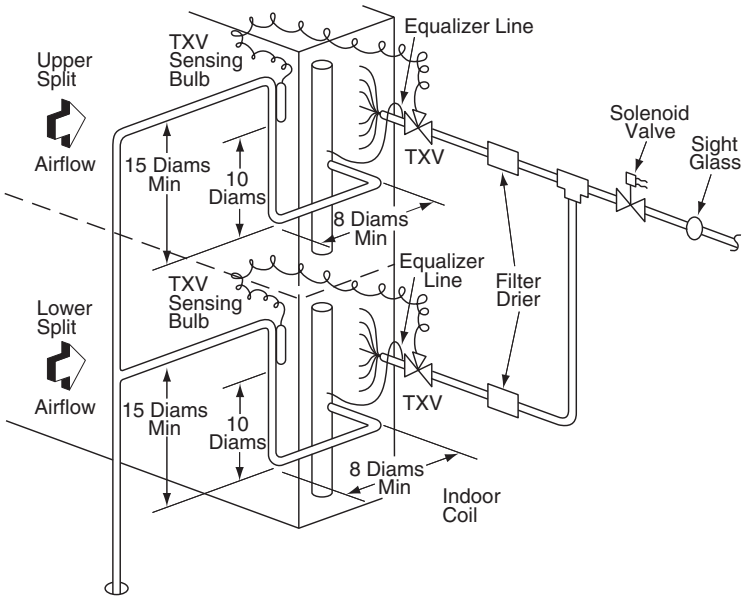


UNIT	USE HOLE NO.[a]	FIELD-FABRICATED HOLE DIAMETERS in (mm)				FIELD-FABRICATED HOLE POSITION DIMENSIONS in. (mm)			
		No. 5	No. 6	No.7	No.8	A	B	C	D
40RUA*25,28,30	1,2,3,4	—	—	—	—	—	—	—	—
40RUS*25	4,5,6,7	1-3/4 (44.5)	1-3/4 (44.5)	1-3/4 (44.5)	—	3.0 (76.2)	6.0 (152.5)	10.5 (266.7)	—
40RUQ*25	3[b],5,6,7	1-1/8 (28.6)	1-1/8 (28.6)	1-3/4 (44.5)	—	3.25 (82.6)	6.125 (155.6)	10.38 (263.7)	
40RUS*28,30	5,6,7,8	2-1/2 (63.5)	2-1/2 (63.5)	2-1/2 (63.5)	2-1/2 (63.5)	6.0 (152.5)	9.625 (244.50)	13.38 (339.9)	17.0 (431.8)

NOTE(S):

a. Access hole knockouts 1-4 are factory-supplied.
b. Must be enlarged from 1-1/8 in. (28.6mm) to 1-3/4 in. (44.5mm)

Fig. 8 — Refrigerant and Chilled Water Piping Access Holes

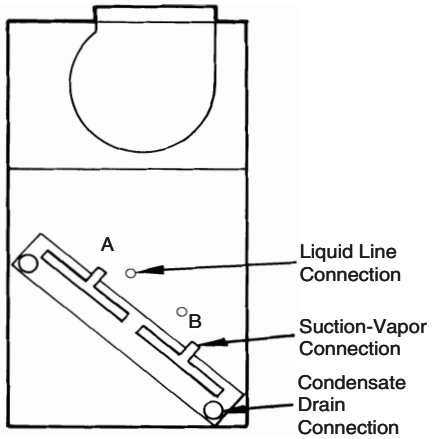


LEGEND

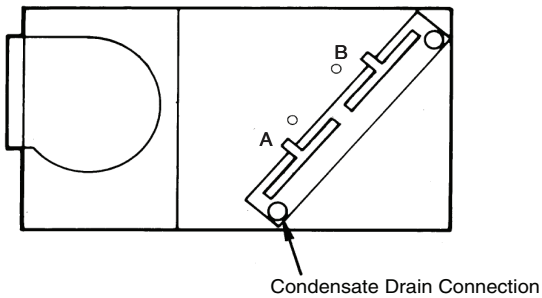
TXV — Thermostatic Expansion Valve

NOTE: Component location arrangement shown for field installation of sight glasses, solenoid valves, filter driers, and TXV sensing bulbs. The TXVs and equilizer lines are factory installed.

Fig. 9 — Face-Split Coil and Liquid Line Piping (Typical)

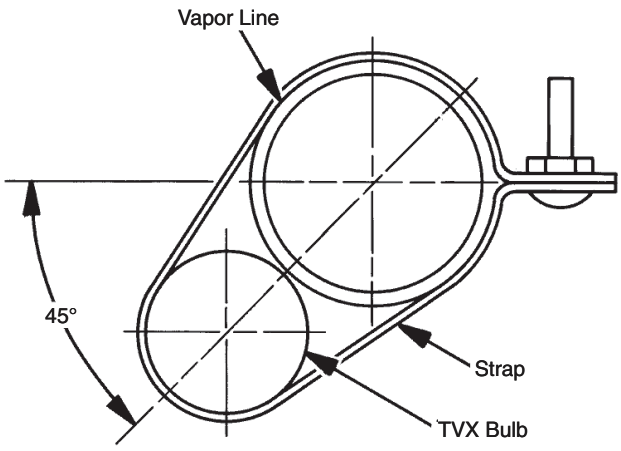


First On/Last Off = B
Vertical Installation



First On/Last Off = A
Horizontal Installation

Fig. 10 — Typical Evaporator Coil Connections (40RU)



LEGEND

TXV — Thermostatic Expansion Valve

NOTE: The 8 o'clock position is shown above.

Fig. 11 — TXV Sensing Bulb Location

Table 7 — Factory-Installed Nozzle and Distributor Data[a]

UNIT	COIL TYPE STD	TXV QTY...PART NO.	DISTRIBUTOR QTY... PART NO.	FEEDER TUBES PER DISTRIBUTOR[b] QTY...SIZE (in.)	NOZZLE QTY...PART NO.
40RUA*25	4 Row	2...BBIZE-8-GA	2...D196-18-3/16	18...3/16	2...G6
40RUA*28	4 Row	2...BBIZE-15-GA	2...1126	20...3/16	2...C15
40RUA*30	4 Row	2...BBIZE-15-GA	2...1126	24...3/16	2...C17
40RUQ*25	4 Row	2...BBIZE-12.5-GA	2...113-12-3/16	2-12...3/16	2...G8

NOTE(S):

a. Hot gas bypass applications require field-supplied auxiliary side connector.
b. Feeder tube size is 1/4 in. (6.35 mm).

Table 8 — Fitting Requirements

UNIT	ACCESS HOLE NO.[a]	CONNECTION TYPE	CIRCUIT	FITTING REQUIRED[b] (in.)
40RUA*25	1	Suction	Lower	1-1/8 Street Elbow 1-1/8 Nipple, 7-5/8 L 1-1/8 Long Radius Elbow
	2	Liquid	Lower	5/8 Street Elbow 5/8 Nipple, 6-1/2 L 5/8 Long Radius Elbow
	3	Liquid	Upper	5/8 Street Elbow 5/8 Nipple, 9-1/2 L 5/8 Long Radius Elbow
	4	Suction	Upper	1-1/8 Nipple, 5-5/8 L 1-1/8 Long Radius Elbow 1-1/8 Nipple, 11 L 1-1/8 Long Radius Elbow
40RUQ*25	3	Suction	Lower	1-1/8 Nipple, 3 L 1-1/8 Long Radius Elbow
	5	Suction	Lower	5/8 Nipple, 2-7/8 L 5/8 45° Elbow 5/8 Nipple, 1-5/8 L 5/8 Long Radius Elbow
	6	Liquid	Upper	5/8 Nipple, 2-7/8 L 5/8 45° Elbow 5/8 Nipple, 4-1/4 L 5/8 Long Radius Elbow
	7	Suction	Upper	1-1/8 Nipple, 5 L 1-1/8 45° Elbow 1-1/8 Nipple, 8-3/4 L 1-1/8 Long Radius Elbow
40RUS*25	4	Supply	Lower	1-3/8 Long Radius Elbow 1-3/8 Nipple, 3-3/4 L 1-3/8 Long Radius Elbow
	5	Return	Lower	1-3/8 Long Radius Elbow 1-3/8 Nipple, 3-3/8 L 1-3/8 Long Radius Elbow
	6	Return	Upper	1-3/8 Long Radius Elbow 1-3/8 Nipple, 7 L 1-3/8 Long Radius Elbow
	7	Supply	Upper	1-3/8 Long Radius Elbow 1-3/8 Nipple, 11-3/4 L 1-1/8 Long Radius Elbow

NOTE(S):

a. Fittings are listed on order from header or tee stub connection out to access hole in corner support post.
b. See Fig. 8 for access hole location by number.

Table 8 — Fitting Requirements (cont)

UNIT	ACCESS HOLE NO.[a]	CONNECTION TYPE	CIRCUIT	FITTING REQUIRED[b] (in.)
40RUA*28	1	Suction	Lower	1-3/8 Street Elbow 1-3/8 Nipple, 11 L 1-3/8 Long Radius Elbow
	2	Liquid	Lower	5/8 Street Elbow 5/8 Nipple, 1-1/2 L 5/8 Long Radius Elbow
	3	Liquid	Upper	5/8 Street Elbow 5/8 Nipple, 19-1/2 L 5/8 Long Radius Elbow
	4	Suction	Upper	1-3/8 Nipple, 4-3/16 L 1-3/8 Long Radius Elbow 1-3/8 Nipple, 23-1/4 L 1-3/8 Long Radius Elbow
40RUS*28,30	5	Supply	Lower	2-1/8 Long Radius Elbow 2-1/8 Nipple, 3-1/2 L 2-1/8 Long Radius Elbow
	6	Return	Lower	2-1/8 Long Radius Elbow 2-1/8 Nipple, 3 L 2-1/8 Long Radius Elbow
	7	Return	Upper	2-1/8 Long Radius Elbow 2-1/8 Nipple, 6-7/8 L 2-1/8 Long Radius Elbow
	8	Supply	Upper	2-1/8 Long Radius Elbow 2-1/8 Nipple, 11-7/8 L 2-1/8 Long Radius Elbow
40RUA*30	1	Suction	Lower	1-3/8 Street Elbow 1-3/8 Nipple, 3 L 1-3/8 Long Radius Elbow
	2	Liquid	Lower	5/8 Street Elbow 5/8 Nipple, 7-3/4 L 5/8 Long Radius Elbow
	3	Liquid	Upper	5/8 Street Elbow 5/8 Nipple, 18-1/2 L 5/8 Long Radius Elbow
	4	Suction	Upper	1-3/8 Nipple, 4-3/16 L 1-3/8 Long Radius Elbow 1-3/8 Nipple, 19-1/4 L 1-3/8 Long Radius Elbow

NOTE(S):

a. Fittings are listed on order from header or tee stub connection out to access hole in corner support post.
b. See Fig. 8 for access hole location by number.

Chilled Water Piping

See Tables 5 and 6 for chilled water connection sizes. For ease in brazing, it is recommended that all internal solder joints be made before unit is placed in final position.

Knockouts are provided in the unit corner posts for 40RUS refrigerant piping. Additional field-fabricated access holes are required for 40RUS chilled water piping. See Fig. 8, which lists recommended knockouts and access holes to use for each 40RUS unit size.

To size, design, and install chilled water piping, consult the Carrier System Design manual. See Fig. 12 for an example of a typical installation. Recommended fittings are listed in Table 8.

To access 40RUS coil vents and drains, remove the unit side panel over the coil header. Vent and drain plugs are on the top and bottom of header, respectively. See the Service section for information on preventing coil freeze-up during winter.

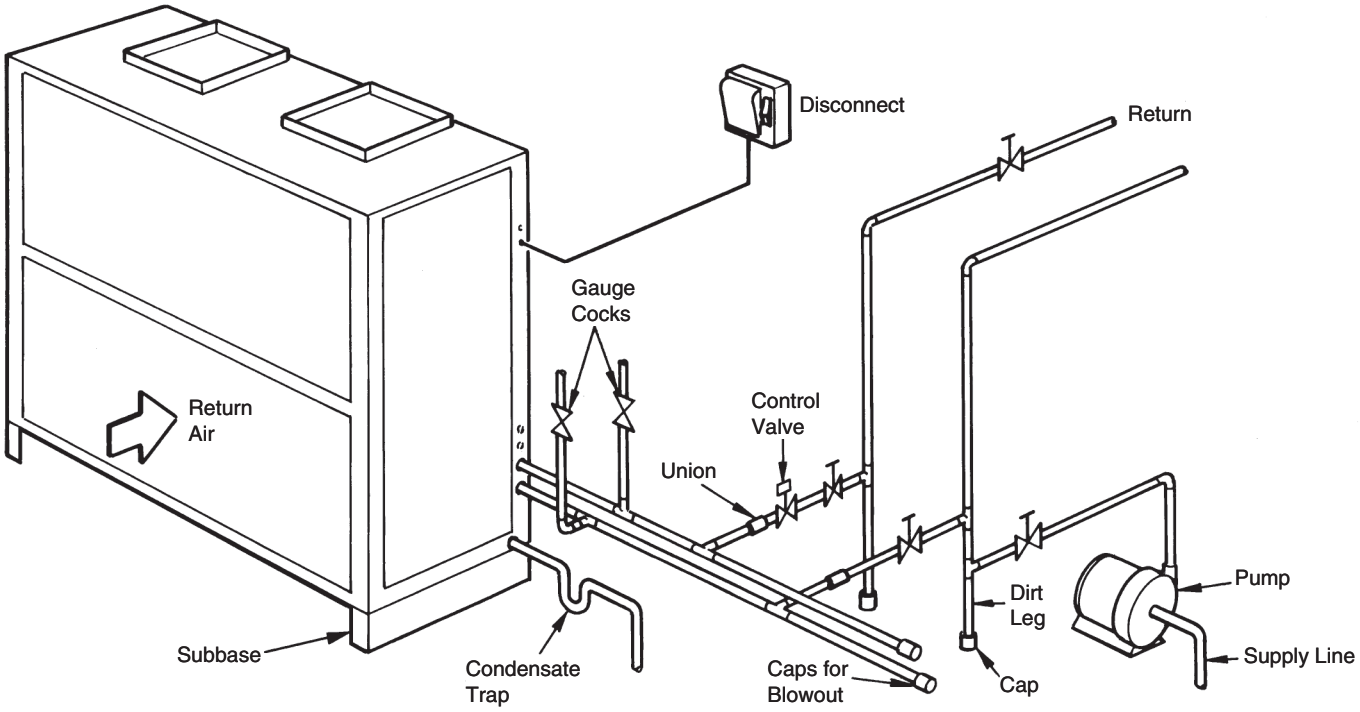
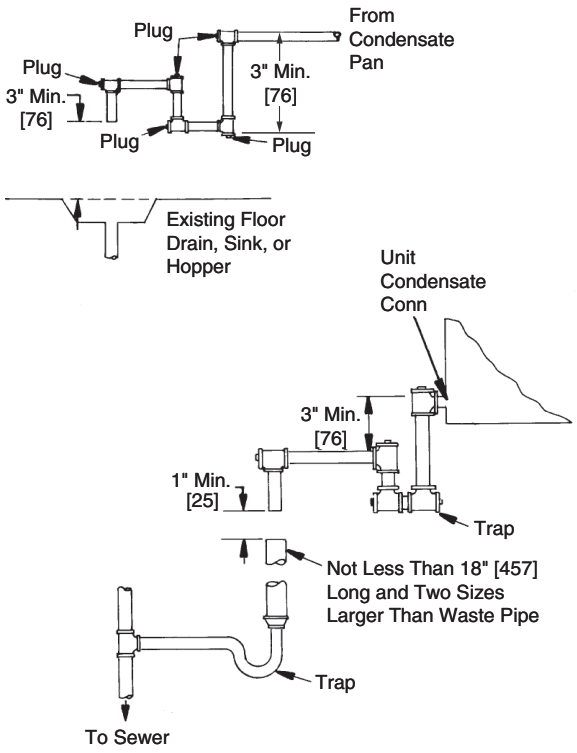


Fig. 12 — Typical 40RUS Chilled Water Piping

Condensate Drain

Install a trapped condensate drain line to unit connection as shown in Fig. 13. The unit drain connection is a PVC stub. (See Fig. 14.) Some areas may require an adapter to connect to either galvanized steel or copper pipe. For these applications, install a field-supplied threaded PVC adapter.



NOTE: Dimensions in [ ] are in millimeters

Fig. 13 — Condensate Drain

NOTE: A trap must be installed in the condensate drain line to ensure that the static pressure of fans is balanced with the water column in the drain line and that condensate can drain completely from pan. Without a trap, air can be drawn up drain line until water level in condensate pan becomes equal to static pressure created by fans, preventing complete drainage. Conditions will worsen as filters become dirty.

Install clean-out plugs in trap. Pitch drain line downward to an open floor drain or sump. Provide service clearance around drain line to permit removal of unit panels. Observe all local sanitary codes.

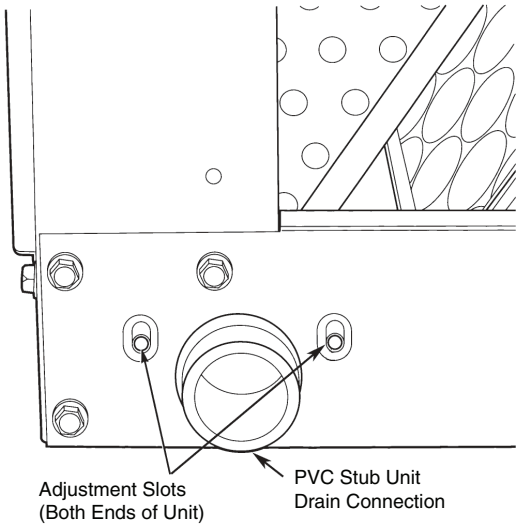


Fig. 14 — Drain Pan Slope Adjustment

As shipped, the unit's condensate drain pan is NOT sloped towards the drain connection. The pan slope must be changed to pitch towards the side of the unit with the drain connection. (See Fig. 14.) Loosen the 2 screws next to the drain outlet at both ends of the unit, push drain pan down in the slots near the drain connection, and up in the slots on the opposite end. Re-tighten screws. The pan should have a pitch of at least 1/4 in. over its length toward the drain connection.

Fan Motors and Drives

Motor and drive packages are factory installed in all units. The motor and drive packages consist of the following items:

1 — Fan motor
1 — Adjustable motor pulley
1 — Fan pulley
2 — Matched fan belts
(40RUA*25-30, 40RUQ*25, 40RUS*25-30 units)

For instructions on changing fan rotation, changing drive speeds and adjusting drives, see Pulley and Drive Adjustment in the Service section.

Power Supply and Wiring

Check the unit data plate to ensure that available power supply matches electrical characteristics of the unit. Provide a disconnect switch with an integrated lock-out feature of size required to provide adequate fan motor starting current. See Table 9 for unit electrical data.

⚠ WARNING

Failure to follow this warning could result in personal injury or death.

Do not use gas piping as an electrical ground.

Unit cabinet must have an uninterrupted, unbroken electrical ground to minimize the possibility of personal injury if an electrical fault should occur. This ground may consist of electrical wire connected to unit ground lug in control compartment, or conduit approved for electrical ground when installed in accordance with NEC (National Electrical Code); ANSI/NFPA 70, latest edition (in Canada, Canadian Electrical Code CSA [Canadian Standards Association] C22.1), and local electrical codes.

⚠ WARNING

FIRE HAZARD

Failure to follow this warning could result in intermittent operation or performance satisfaction.

Do not connect aluminum wire between disconnect switch and fan coil unit. Use only copper wire. (See Fig. 15.)

Table 9 — 40RU**25-30 Electrical Data

UNIT[a, b]	V-PH-Hz	IFM TYPE	VOLTAGE LIMITS[c]		FAN MOTOR			POWER SUPPLY[d]	
			Min	Max	Hp	(kW)	FLA[e]	MCA	MOCP
40RUA/S/Q*25	208/230	STD	187	253	5.0	3.73	18.0	23	40
		MED	187	253	5.0	3.73	18.0	23	40
		HIGH	187	253	7.5	5.60	23.5	30	50
	460	STD	414	506	5.0	3.73	9.1	12	20
		MED	414	506	5.0	3.73	9.1	12	20
		HIGH	414	506	7.5	5.60	15.0	19	30
	575	STD	518	632	5.0	3.73	8.0	10	15
		MED	518	632	5.0	3.73	8.0	10	15
		HIGH	518	632	7.5	5.60	10.0	13	20
40RUA/S*28	208/230	STD	187	253	7.5	5.60	23.5	30	50
		MED	187	253	10.0	7.46	32.0	40	70
		HIGH	187	253	10.0	7.46	32.0	40	70
	460	STD	414	506	7.5	5.60	15.0	19	30
		MED	414	506	10.0	7.46	16.0	20	35
		HIGH	414	506	10.0	7.46	16.0	20	35
	575	STD	518	632	7.5	5.60	10.0	13	20
		MED	518	632	10.0	7.46	13.0	17	25
		HIGH[f]	518	632	10.0	7.46	13.0	17	25
40RUA*30	208/230	STD	187	253	10.0	7.46	32.0	40	70
		MED	187	253	10.0	7.46	32.0	40	70
		HIGH	187	253	10.0	7.46	32.0	40	70
	460	STD	414	506	10.0	7.46	16.0	20	35
		MED	414	506	10.0	7.46	16.0	20	35
		HIGH	414	506	10.0	7.46	16.0	20	35
	575	STD	518	632	10.0	7.46	13.0	17	25
		MED	518	632	10.0	7.46	13.0	17	25

NOTE(S):

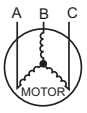
a. Unbalanced 3-Phase Supply Voltage: Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the formula in the example below to determine the percentage of voltage imbalance.
b. Installation with Accessory Electric Heaters: Size the Field Power Wiring between the heater TB1 and the 40RU indoor fan motor per NEC Article 430-28 (1) or (2) (depends on length of conduit between heater enclosure and 40RU power entry location). Install wires in field-installed conduit.
c. Motors are designed for satisfactory operation within 10% of normal voltage shown. Voltages should not exceed the limits shown in the Voltage Limits column.
d. Minimum circuit amps (MCA) and MOCP values are calculated in accordance with The NEC. Article 440.
e. Motor FLA values are established in accordance with Underwriters' Laboratories (UL). Standard 1995.
f. Data for 575v high static applies to 40RUA*28 only, not 40RUS*28.

$$\text{\% Voltage Imbalance} = 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

LEGEND

FLA — Full Load Amps
MCA — Minimum Circuit Amps
MOCP — Maximum Overcurrent Protection

Example: Supply voltage is 230-3-60



AB = 224 v
BC = 231 v
AC = 226 v

$$\text{Average Voltage} = \frac{(224 + 231 + 226)}{3} = \frac{681}{3} = 227$$

Determine maximum deviation from average voltage.

(AB) 227-224 = 3 v

(BC) 231-227 = 4 v

(AC) 227-226 = 1 v

Maximum deviation is 4 v.

Determine percent of voltage imbalance.

$$\text{\% Voltage Imbalance} = 100x \frac{4}{227} = 1.78\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

Install disconnect switch and power wiring in accordance with all applicable local codes. See Fig. 15-17 and the unit label diagram. Connect power wiring with 1/4 in. ring terminal.

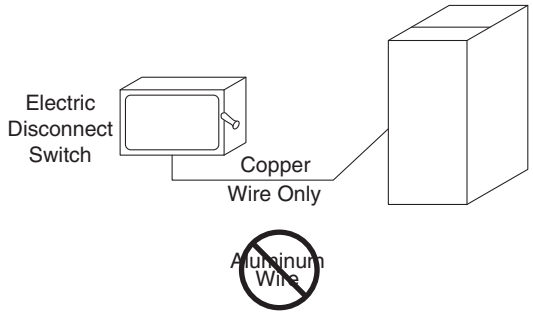
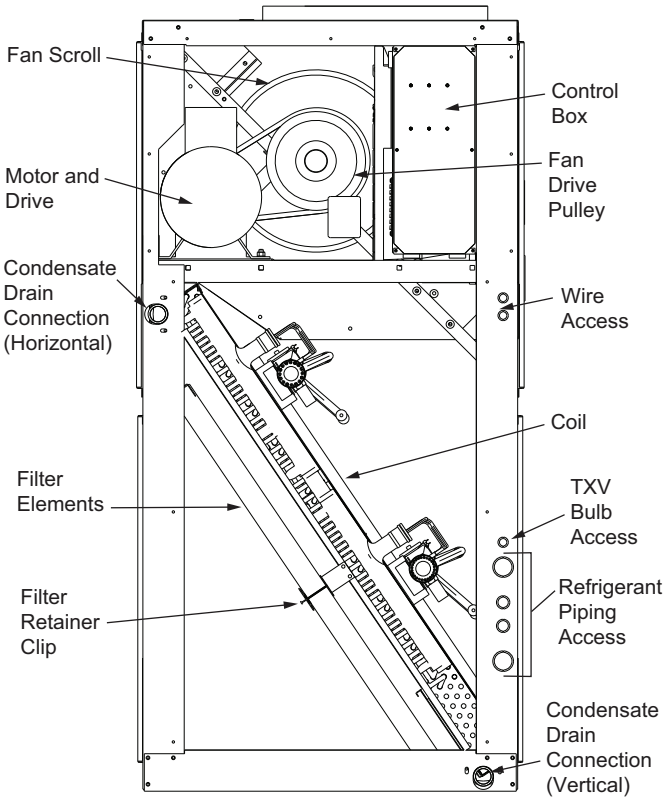


Fig. 15 — Disconnect Switch and Unit



LEGEND
TXV —Thermostatic Expansion Valve

Fig. 16 — Wiring and Service Access (Side Panel Removed)

Fan motors are factory-installed on all units. The control box (see Fig. 17) contains a Unit Control Board (UCB) that receives thermostat commands from the thermostat (through the Thermostat Connection Board [TSTAT CB]) and outputs these commands to the condensing unit (through the Indoor Connection Board [IDCB]). The control box also contains a high voltage terminal block and fuses that provide overcurrent protection to the Variable Frequency Drive.

Complete 24-v control circuit wiring. Wire the thermostat to TSTAT CB terminal block (see Fig. 17), according to Fig. 18 and the unit label diagram. If the air handler is part of a split system, complete the wiring from the condensing unit to the IDCB terminal block (see Fig. 15). Refer to Fig. 18 and the unit label diagram.

THREE STAGE OPERATION

All units are factory shipped for 2-stage cooling operation. To convert a unit to 3-stage operation, see Fig. 19 adjust the following wires between the control board and two terminal strips on the side of the control box:

1. Remove gray wire from Thermostat CB terminal X.
2. Move orange wire from Thermostat CB terminal Y2 to terminal X.
3. Make connections of blue wire included in factory harness. Connect one end to Thermostat CB terminal Y2 and the other to Indoor Connection Board terminal Y2.
4. Move orange wire from Indoor Connection Board terminal Y2 to terminal X.

The 3-stage system will run the fan at low speed with a G, Y1, and Y1+Y2 call, and at high speed with a call for Y1, Y2, and Y3. A thermostat with 3 cooling stage capability is required for this system configuration.

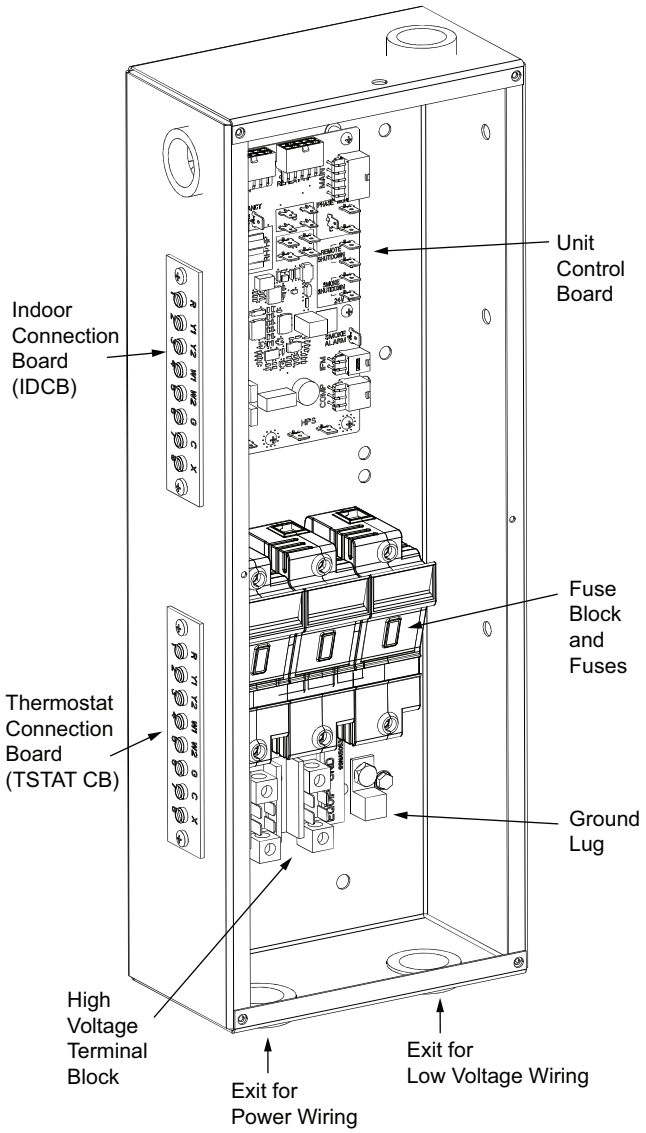
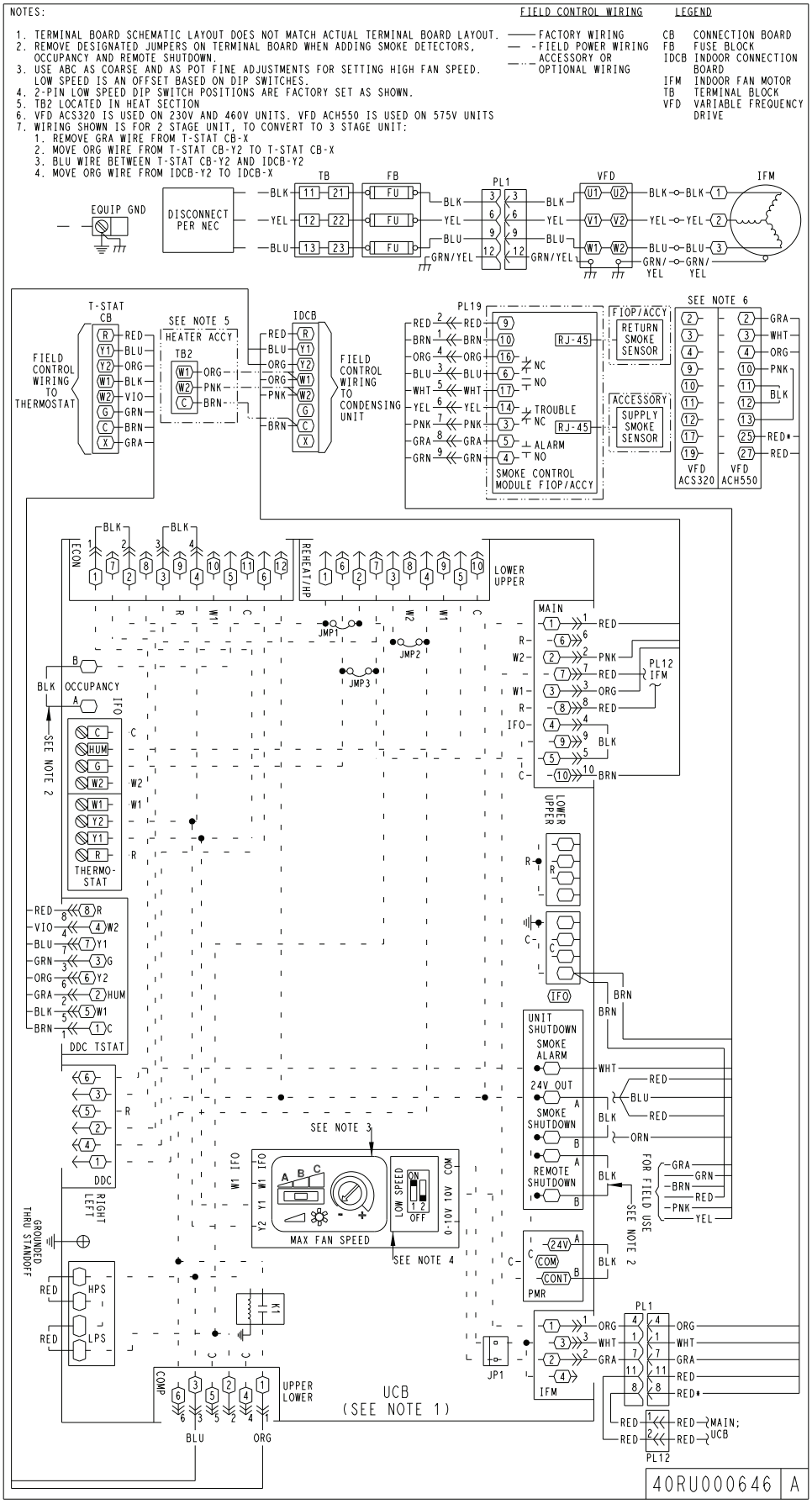


Fig. 17 — Control Box (Cover Removed) (Typical)

FREEZE PROTECTION

On select models, there is a factory-installed and wired temperature switch (HH18HB016) to protect the compressor(s) in the condensing unit when frost buildup is present on the indoor coil. The temperature switch is used to prevent the compressor(s) from turning on while the indoor coil is frosted. Refer to the unit wiring label diagram for wiring of this switch.



NOTE: On select units, the black and blue IFM wires are reversed.

Fig. 18 — Unit Wiring

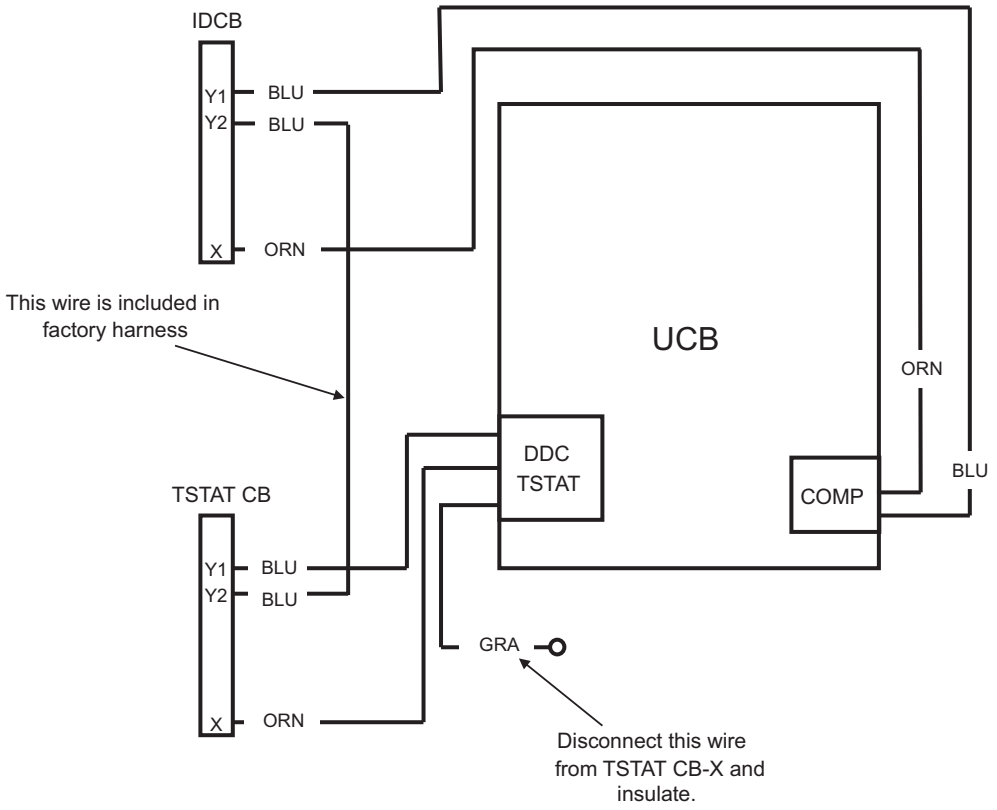


Fig. 19 — 3-Stage Cooling Diagram

Variable Frequency Drive

The unit is equipped with a Variable Frequency Drive (VFD) to control the indoor fan in sequence with the unit's ventilation, cooling, and heating operation. The VFD is controlled through a 0-10vdc signal that is provided by the Unit Control Board (UCB) in the control box. Per ASHRAE 90.1-2016 and IECC-2015 standards, during the first stage of cooling operation, the VFD will adjust the fan motor to provide 66% of the design airflow rate for the unit. When the call for the second stage of cooling is required, the VFD will allow the design airflow rate for the unit established (100%). During heating mode, the VFD will allow total design airflow rate (100%) operation. During ventilation mode, the VFD will operate the fan motor at 66% of full speed.

The ABB ACS320 model (see Fig. 20) is used on 208/230v and 460v units, while the ABB ACH550 model (see Fig. 21) is used on 575v units.

See Fig. 22-25 for location of the VFD.

Fig. 20 — ACS320 Variable Frequency Drive (VFD)

Fig. 21 — ACH550 Variable Frequency Drive (VFD)

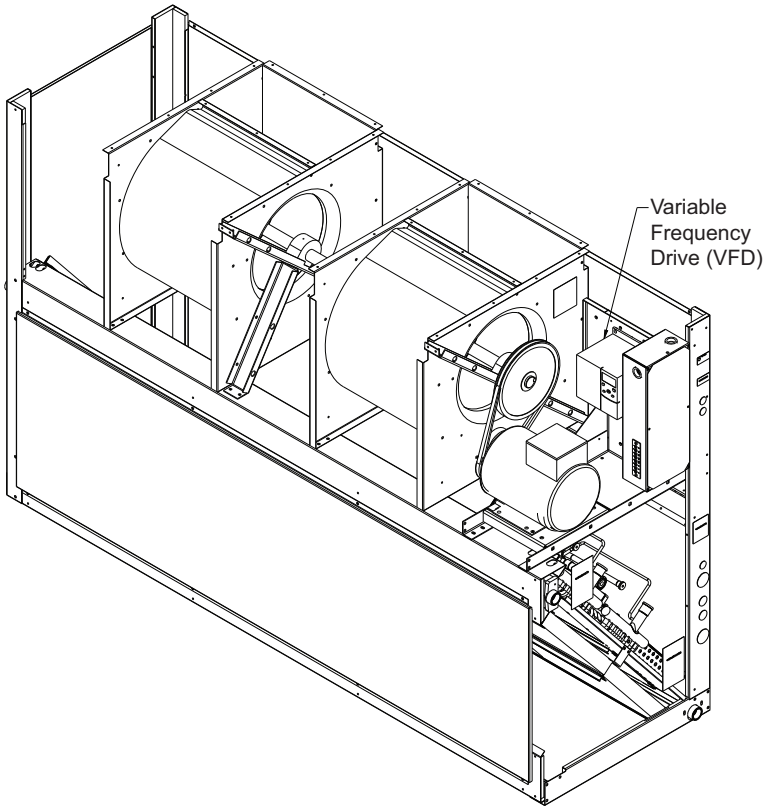


Fig. 22 — ACS320 VFD Location for the following units: 40RUA/RUS 25, 40RUQ 25 (208/230V and 460V only)

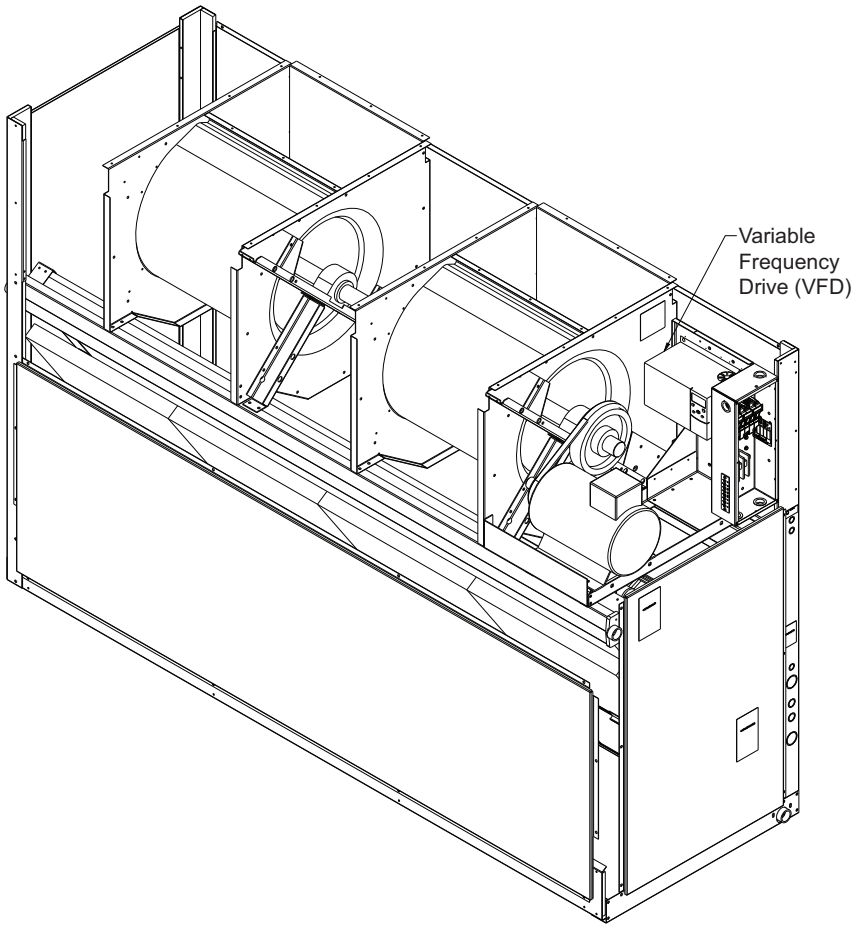


Fig. 23 — ACS320 VFD Location for the following units: 40RUA/RUS 28-30 (208/230V and 460V only)

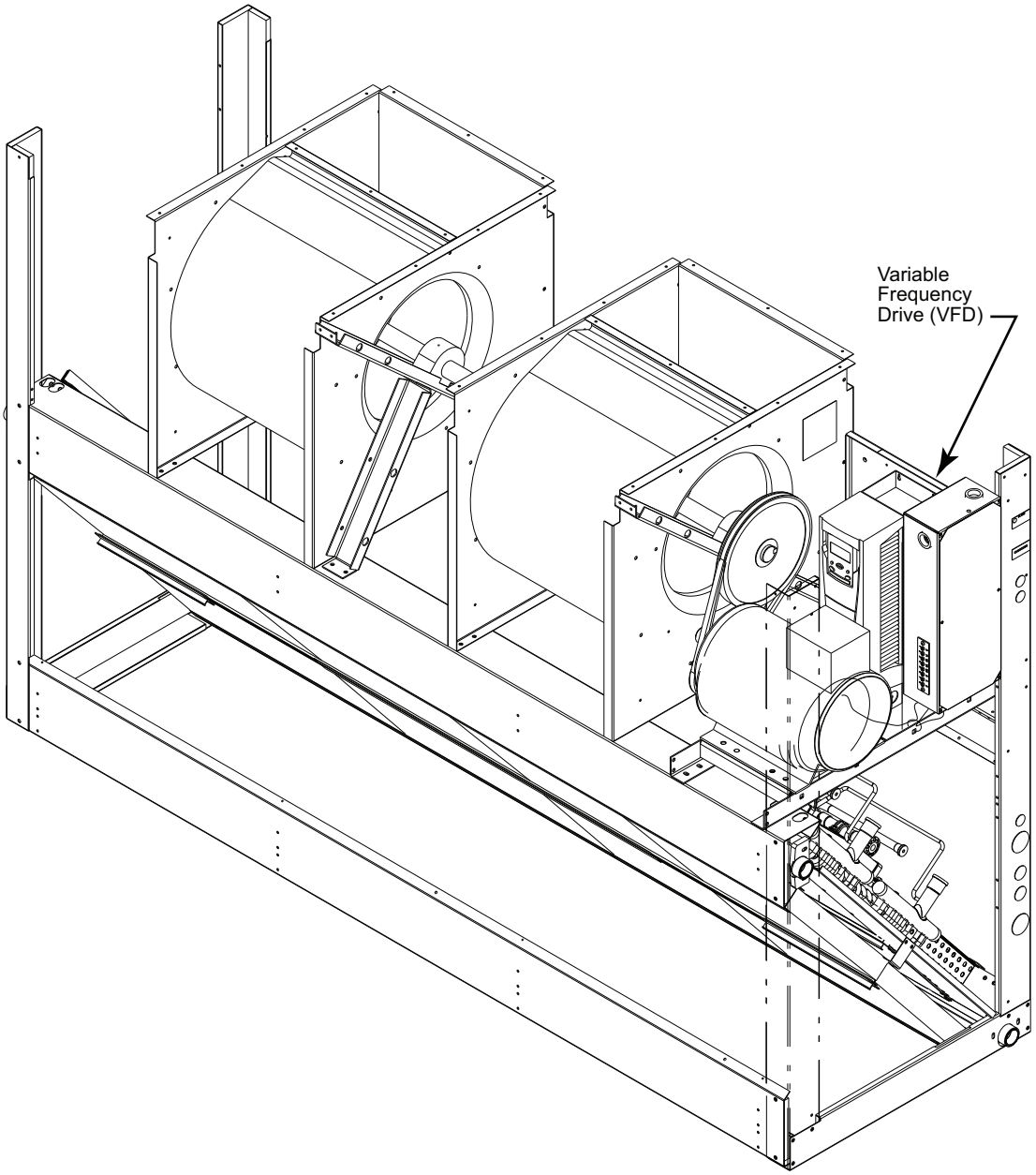


Fig. 24 — ACH550 VFD Location for the following units: 40RUA/RUS 25, 40RUQ 25 (575V only)

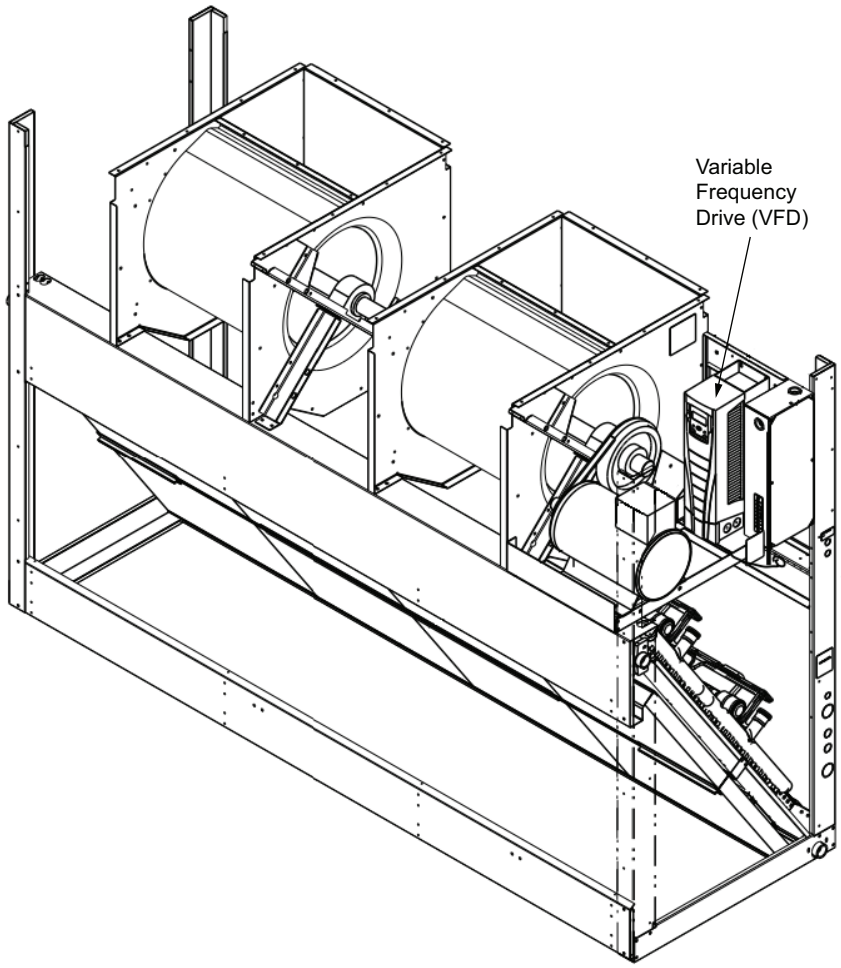


Fig. 25 — ACH550 VFD Location for the following units: 40RUA/RUS 28-30 (575V only)

Connecting Ductwork

Refer to the Carrier System Design Manual for the recommended design and layout of ductwork. Figure 26 shows recommended duct connection to units with 2 fans.

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution could cause equipment damage.

Do not operate unit without ductwork or discharge plenum unless fan speed has been adjusted for external static pressure of 0 in. wg. Failure to do so may result in motor overload.

DISCHARGE CONNECTIONS

Duct flanges are factory-supplied; they are shipped inside the unit attached to the hairpin end of the coil tube sheet for field installation. Using the existing screws, install the duct flanges on the unit's fan deck. Each fan discharge requires 2 flanges; each flange must be bent in the middle to conform to the discharge opening. (See Fig. 27.) After flanges are installed, connect them to the supply duct using a canvas connection to prevent vibration. It is important that this connection be properly fabricated to prevent high air friction losses and air noise.

RETURN CONNECTIONS

When using return-air ductwork, route return-air duct to the unit's return air inlet near the filter rack, using a canvas connection to prevent transmission of unit vibration. If the duct blocks off the unit's access panel, provide a slip joint in the ductwork to permit removal for servicing.

OUTDOOR-AIR INLET CONNECTIONS

Connect outdoor-air inlet to field-installed accessory economizer. Refer to Economizer Installation Instructions.

Return-Air Filters

Type and size of filters are shown in Tables 1-6 and are factory-supplied and factory-installed. In all units with 2 fans, a filter replacement tool (hook) is shipped inside the unit for field use when replacing filters. See the Service section for instructions on filter element replacement.

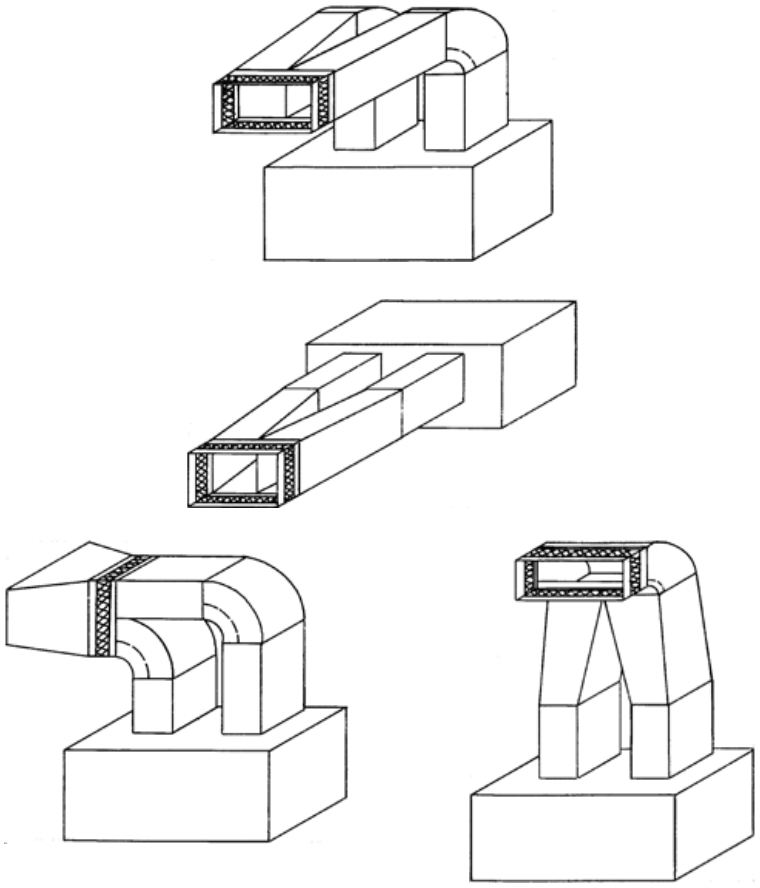


Fig. 26 — Typical Fan Discharge Connections for Multiple Fan Units

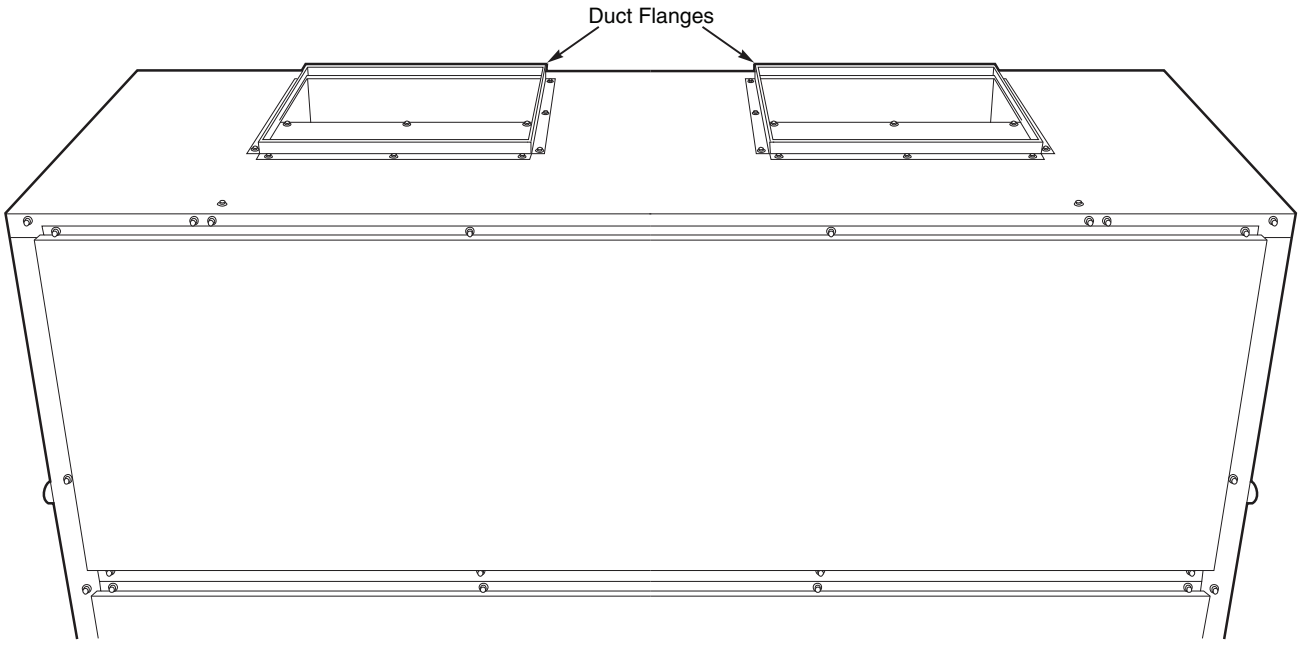


Fig. 27 — Duct Flange Installation

START-UP

Before starting unit, check the following and correct as necessary:

- Is unit solidly supported?
- Is fan adjusted for speed and pulley alignment?
- Are pulleys, motor, and bearings securely mounted?
- Are there any loose parts that will rattle or vibrate?
- Is condensate drain pan pitched for correct drainage?
- Are coil baffle plates tight against coil to prevent air bypass?
- Are all panels securely fastened?
- Are all electrical connections correct and tight?
- Are there any loose or disconnected wires at the VFD or in the control box? Are any wires in contact with sharp edges or moving parts (e.g., pulley, belt, etc.)?
- Have all safety, caution, and warning labels been read?

40RUA and 40RUQ ONLY

- Is TXV bulb located on suction tube per Fig. 28?
- Is the capillary tube to the bulb free of kinks and not subject to pinching?
- Is the bulb well secured to the suction tube with strap?

Also refer to condensing unit or outdoor heat pump section instructions before starting a split system. A split system start-up checklist is provided at the end of these instructions.

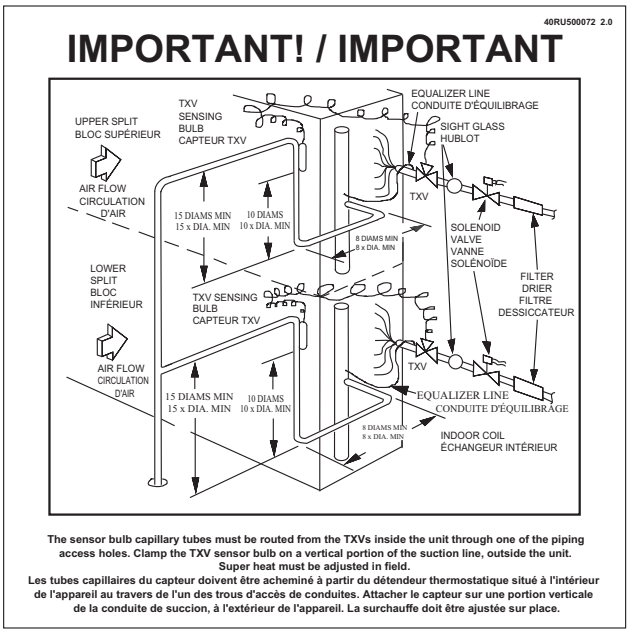


Fig. 28 — TXV Bulb Location Label

Adjusting TXV for Superheat (40RUA and 40RUQ only)

The unit-mounted thermostatic expansion valve(s) is/are factory set to provided superheat at the bulb location in 10°F to 15°F (5.5°C to 8.3°C) range. Actual system load conditions may require adjustment of the factory setting. (See Fig. 29.)

To adjust the TXV superheat setting:

1. Remove the seal cap from the bottom of the TXV body.
2. To increase superheat, turn the stem clockwise. To decrease the superheat, turn the stem counterclockwise. Do not turn the stem more than one full turn.
3. Wait until suction pressure and superheat stabilize. This may take more than 30 minutes.
4. Continue adjustment until superheat reaches 10°F to 15°F (5.5°C to 8.3°C).
5. Replace the seal cap; tighten.

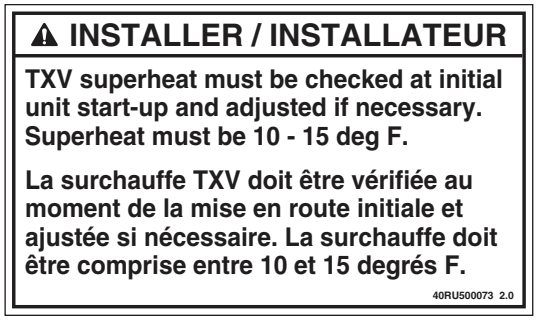


Fig. 29 — TXV Adjustment Label

Compressor Rotation

Follow instructions in Condensing Unit installation instructions. For units equipped with a VFD on the indoor fan motor, the rotation direction of the indoor fan motor and fan cannot be used to visually confirm a correct phase connection to the unit and compressors. Correct phases to equipment for proper compressor rotation. The VFD will maintain the same rotation as input phases are changed. Pressure gages MUST BE USED during cooling system start-up to confirm correct compressor rotation and operation.

Indoor Fan Motor

Raise the cooling set point at the space thermostat to higher than the space temperature. Switch the thermostat's FAN switch to the CONT (Continuous) position. The fan motor will start and run at reduced speed. Check for fan rotation direction. To reverse the fan rotation, disconnect all power to the unit and then switch two motor power leads between the VFD and the motor. Restore unit power and recheck the fan rotation direction.

Check fan motor speed. Motor shaft should be rotating at 1150 to 1180 rpm (19.2 to 19.7 r/s).

Switch the thermostat's FAN switch to AUTO position. Fan motor will stop.

Cooling with Staged Air Volume (SAV™)

FIRST STAGE (Y1)

Set the thermostat FAN switch to AUTO and the SYSTEM switch to COOL. Slowly lower the cooling set point until first stage compressor starts. Indoor fan motor also starts and runs at reduced speed.

SECOND STAGE (Y2)

Lower the cooling set point until the second stage compressor starts. The indoor fan speed is dependent on the number of cooling stages:

- 2-Stage Systems: The indoor fan motor will switch to high speed.
- 3-Stage Systems: The indoor fan motor will remain at low speed.

THIRD STAGE (Y3) — 3-STAGE SYSTEMS ONLY

Lower the cooling set point until the third stage compressor starts. The indoor fan motor will switch to high speed.

Check the fan motor speed. Motor shaft should be rotating at 1725 to 1760 rpm (28.8 to 29.3 r/s).

Confirm compressors are running at correct rotation by checking suction and discharge pressures. To reverse the compressor rotation, disconnect unit power and switch two of the unit's main power leads. Restore unit power and recheck compressor operation.

Reset thermostat cooling set point to a position above the space temperature.

Both compressors will shut off. Indoor fan motor will stop immediately.

Operating Fan for Test and Balance

During the Test and Balance procedure, it is necessary to operate the supply fan in High Speed without concurrent operation of the Cooling or Heating systems. Use the following procedure to force the fan speed to High.

1. Set the space thermostat to SYSTEM OFF and FAN in AUTO.
2. Disconnect unit power. Lock-out/tag out.
3. Open the fan access panel and remove the cover of control box.
4. Adjust the Low Speed 2-Pin DIP switches on the Unit Control Board. Set both switches to "OFF." This will allow the motor to run at full speed in ventilation only.
5. Locate pressure ports or pitot tubes in the return duct and supply duct to measure external static pressure.
6. Replace control box cover.
7. Restore unit power.
8. Set the space thermostat to FAN CONT.
9. Check the motor speed with stroboscope or similar tool. Motor shaft speed must be in 1725 to 1760 rpm (28.8 to 29.3 r/s) range for High Speed.
10. Replace the fan access panel.
11. Perform test and balance procedure.
12. Adjust the supply fan speed according to the Pulley and Drive Adjustment section to deliver the project selection cfm value. Ensure the selection cfm value is not lower that the "Min cfm Per Fan Motor Type" for this unit-size as found in Table 10. See Fan Speed Set-Up section for alternate method of adjusting supply fan speed through the Unit Control Board.

To restore the unit to ready-to-start condition, disconnect the unit power and lock-out/tag-out, set the space thermostat to FAN AUTO, remove the test pressure ports from the external duct locations, and re-set Low Speed 2-Pin DIP switches to factory setting (refer to wiring diagram on control box cover). Replace the supply fan access panel. Restore unit power.

Table 10 — 40RU Min CFM Per Fan Motor Type

UNIT	2-SPEED FAN MOTOR (AT HIGH SPEED)	2-SPEED FAN MOTOR (AT LOW SPEED)
40RUA/S/Q*25	7,500	5,000
40RUA/S*28	8,450	5,633
40RUA/S*30	10,140	6,760

Fan Speed Set-Up

These units contain a variable frequency drive (VFD) fan assembly. The fan operates from a 0-10 Vdc signal.

NOTE: The indoor fan motors are equipped with protection relays designed to disable unit operation when a problem is detected. See Typical Wiring Diagram (see Fig. 18) for the red wires in the Indoor fan control.

Fan motor is wired to connect the motor protection relays in series.

UNITS WITH ELECTRO-MECHANICAL CONTROLS

The fan speed set up controls are located on the lower section of the Unit Control Board (UCB). (See Fig. 30.)

The Unit Control Board (UCB) voltage is set for 10 Vdc from the factory to allow for full speed with belt/pulley adjustments.

The following procedure will allow for fan speed reduction if desired.

1. Check the job specifications for the CFM (cubic feet per minute) and ESP (external static pressure) required.
2. Connect a multimeter to the Vdc terminals on the UCB.
3. Set the Range Switch to either A, B, or C per the Switch Range table. A is the lowest speed range, B is the middle speed range and C is the highest speed range.
4. Using a straight blade screwdriver, turn the Vdc control dial to fine tune the Vdc reading until the unit matches the required airflow setting.
5. Record the reading in the Field Setting field.

NOTE: Fan set-up Vdc is not affected by the operating stage of the unit.

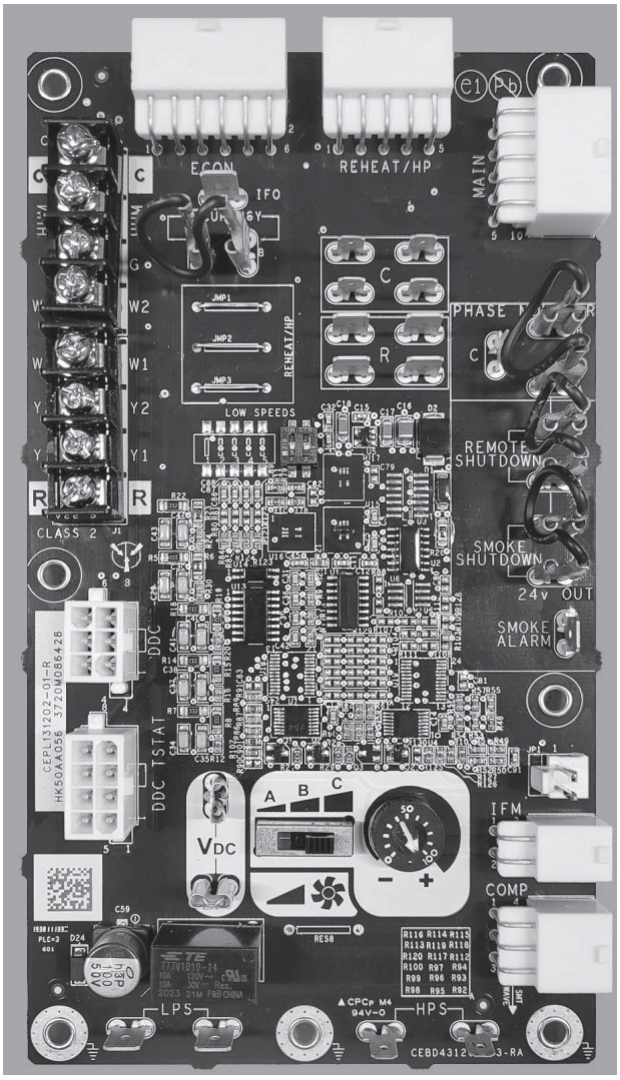


Fig. 30 — Unit Control Board

MAINTENANCE

These items should be part of a routine maintenance program, to be checked every month or two, until a specific schedule for each can be identified for this installation:

Quarterly Inspection (and 30 days after initial start)

INDOOR SECTION

- Condenser coil cleanliness checked.
- Return air filter replacement
- Outdoor hood inlet filters cleaned
- Fan shaft bearing locking collar tightness checked
- Condensate drain checked

Heating

- Power wire connections
- Fuses ready
- Manual-reset limit switch is closed

See Tables 11 and 12 for unit specific maintenance checklists.

Seasonal Maintenance

These items should be checked at the beginning of each season (or more often if local conditions and usage patterns dictate):

AIR CONDITIONING

- Condenser fan motor mounting bolts tightness
- Compressor mounting bolts
- Condenser fan blade positioning
- Control box cleanliness and wiring condition
- Wire terminal tightness
- Refrigerant charge level
- Evaporator coil cleaning
- Evaporator blower motor amperage

Table 11 — Outdoor Unit Maintenance Checklist

MAINTENANCE CHECKLIST[a]	RECOMMENDED INTERVAL[b]	
Outdoor unit specific:	**Monthly**	**Annual**
Clear away debris and vegetation near unit.	X	
Inspect cabinet for damage. Replace components that are damaged or severely rusted.		X
Inspect electrical disconnect for proper function. Repair or replace as necessary.		X
Inspect electrical wiring and connections. Tighten loose connections. Inspect and perform functional test of equipment as needed to ensure proper function. Repair or replace damaged or overheated components and wiring.		X
Check refrigerant system subcooling and superheat.		X
Inspect inside of unit. Clean if debris is present.		X
Inspect condenser coil. Clean if dust, dirt, or debris is present. Rinse unit with fresh water.[c]		X[d]
Inspect motor and fan for damage. Make sure fans spin freely.		X

NOTE(S):

a. The above list may not include all maintenance items. Inspection intervals may vary depending on climate and opening hours. Consult your Carrier dealer about a service contact for seasonal inspections
b. Monthly maintenance items and outdoor unit rinsing may be performed by the customer. All other maintenance items and all service work must be performed by a qualified service technician. Read all warning labels.
c. Do not use harsh chemicals or high pressure water on coils. More frequent rinsing is required near a sea cost.
d. Monthly rinsing of the condenser coil is recommended if the unit is located in a corrosive climate.

Table 12 — Indoor Unit Maintenance Checklist

MAINTENANCE CHECKLIST[a]	RECOMMENDED INTERVAL[b]	
Indoor unit specific: (for accessories refer to unit specific literature)	**Monthly**	**Annual**
Inspect, clean, or replace air filter if dirty.	X	
Inspect and clean blower assembly (includes blower housing, wheel, and motor). Lubricate shaft bearings.		X
Inspect internal and external cabinet. Clean as needed.		X
Inspect electrical disconnect for proper function. Repair or replace as necessary.		X
Inspect electrical components, wiring, and connections. Tighten loose connections. Repair or replace damaged components and wiring.		X
Inspect evaporator coil. Clean if dust, dirt, or debris is present.[c]		X
Clean condensate pan, trap, and drain lines (more frequent maintenance may be required in humid climates — consult your local HVAC dealer).		X
Inspect motor and fan for damage. Make Inspect airflow system (ductwork). Check for leaks and repair as needed.		X

NOTE(S):

a. The above list may not include all maintenance items. Inspection intervals may vary depending on climate and opening hours. Consult your Carrier dealer about a service contact for seasonal inspections
b. Monthly maintenance items and outdoor unit rinsing may be performed by the customer. All other maintenance items and all service work must be performed by a qualified service technician. Read all warning labels.
c. Do not use harsh chemicals or high pressure water on coils. More frequent rinsing is required near a sea cost.

SERVICE

Inspection and maintenance should be performed at regular intervals and should include the following:

- Complete cleaning of cabinet, fan wheel, cooling coil, condensate pan and drain, heating coils, and return-air grille (if present).
- Inspection of panels and sealing of unit against air leakage.
- Adjustment of fan motor, belt, bearings, and wheels.
- Cleaning or replacement of filters.
- Testing for cooling/heating system leaks.
- Checking of all electrical connections.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Before performing service or maintenance operations on unit, always turn off main power switch to unit and install lockout tag. Unit may have more than one power switch.

Most unit service can be performed by removing one or both of the unit's side panels. Coil cleaning, removal or insulation cleaning may require removal of a rear, top, or bottom panel, depending on the unit's orientation. When service is completed, replace unit panels.

Panels

Panels are fastened to unit frame with sheet metal screws. Fan and coil compartment must be sealed tightly after service to prevent air from bypassing the cooling coil.

Fan Motor Lubrication

Fan motor supplied with unit is permanently lubricated and requires no further lubrication.

Fan Shaft Bearings

Size 25-30 units have pillow-block bearings (Fig. 31) that must be lubricated with suitable bearing grease approximately every 3 months. See Table 13 for suitable lubricants.

Table 13 — Lubricant Data

MANUFACTURER	LUBRICANT
Mobil	Mobilplex EP No. 2
Sunoco	Prestige 42
Texaco	Multifak 2
Texaco	Regal AFB-2[a]

NOTE(S):

a. Preferred lubricant, contains rust and oxidation inhibitors.

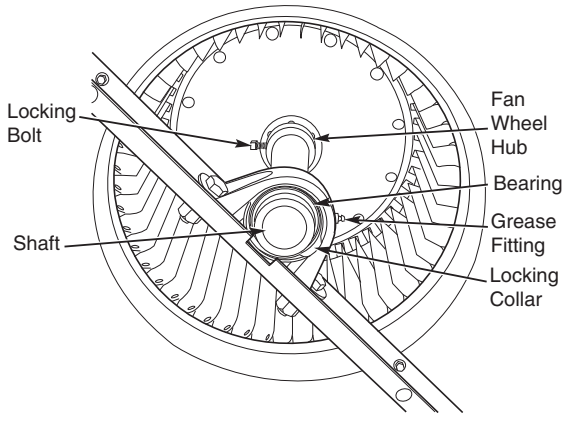


Fig. 31 — Fan Shaft, Bearings, and Fan Wheel (Typical)

Centering Fan Wheel

If fan and fan shaft assembly are not properly centered, blades may scrape against the blower side scroll plate or may create an objectionable whistling noise. It may be necessary to adjust individual fan wheels or move entire fan shaft. See the Fan Shaft Position Adjustment and Individual Fan Wheel Adjustment sections that follow.

Fan Shaft Position Adjustment

Loosen setscrew or locking collar of each fan shaft bearing. Slide shaft into correct position and replace locking collar. (See Fig. 32). To replace locking collar, push collar up against inner face of bearing. Turn collar in direction of fan rotation until tight, and tighten setscrew. Tightening locking collar in direction of fan rotation results in further tightening of collar should setscrew work itself loose.

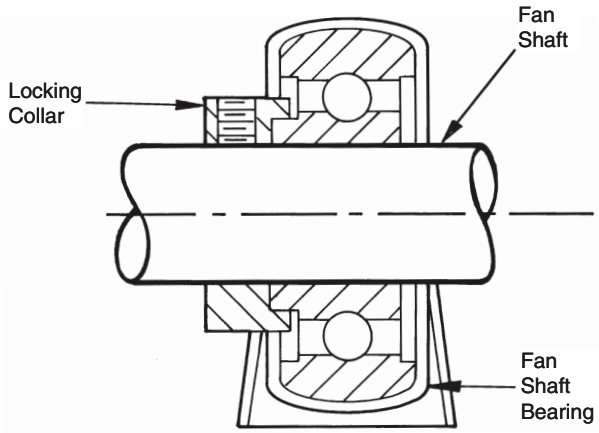


Fig. 32 — Fan Shaft Bearing

Individual Fan Wheel Adjustment

Loosen the 2 locking bolts holding the fan wheel hub to shaft. (See Fig. 31.) Position fan wheel in center of the fan housing and tighten locking bolts. Clearance between wheel and housing should be the same on both sides.

Fan Belts

Motor mounting plate and motor support angles are slotted to permit both vertical and horizontal adjustment. Adjust belt(s) for correct deflection by loosening motor plate mounting bolts, moving motor/plate assembly forward or back, and re-tightening bolts. Press down on belt with one finger midway between fan and motor pulleys to check deflection. The correct deflection is 1/8 in. (3.2 mm). (See Fig. 33.)

If complete belt replacement is required during servicing, loosen the motor plate mounting bolts (Fig. 33), move motor/plate assembly towards fan pulley, and pull belt(s) off pulleys. Reverse the procedure with new bolts and readjust deflection.

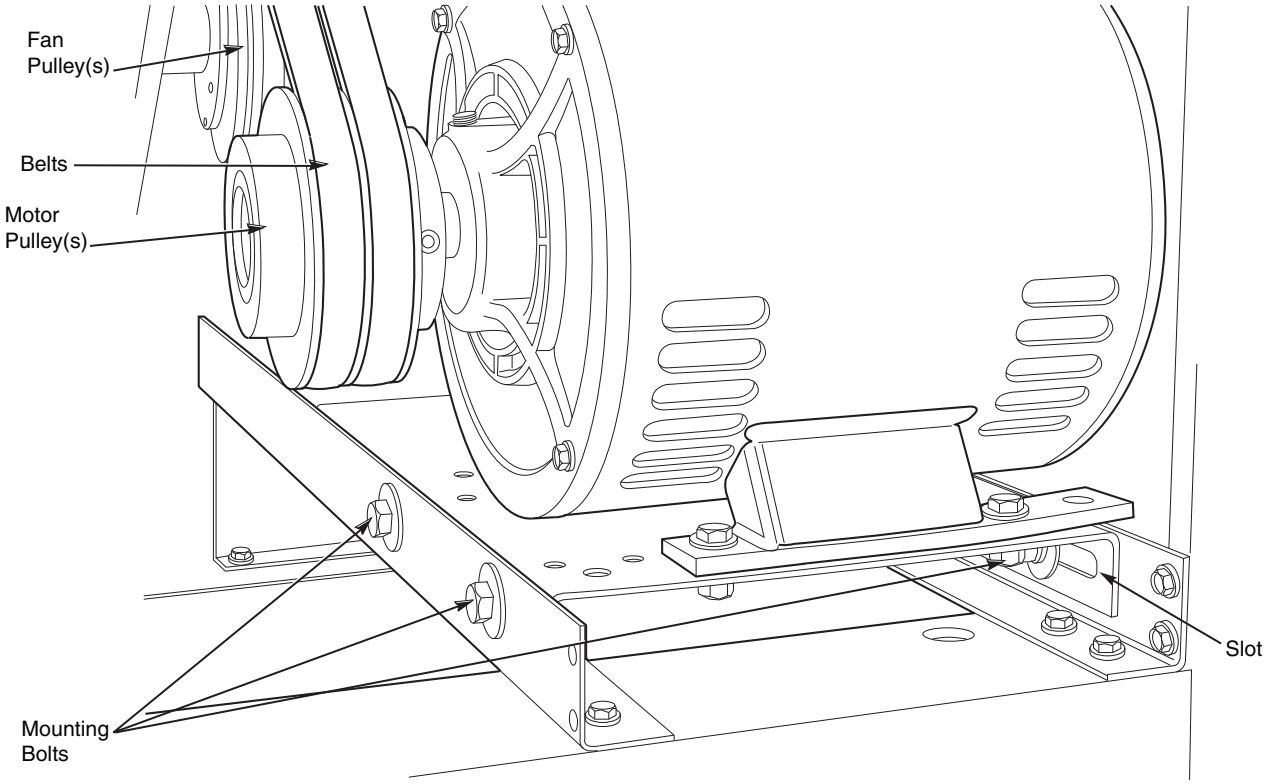


Fig. 33 — Fan Motor Mounting

Fan Rotation

Correct fan rotation with respect to fan outlet is shown in Fig. 34.

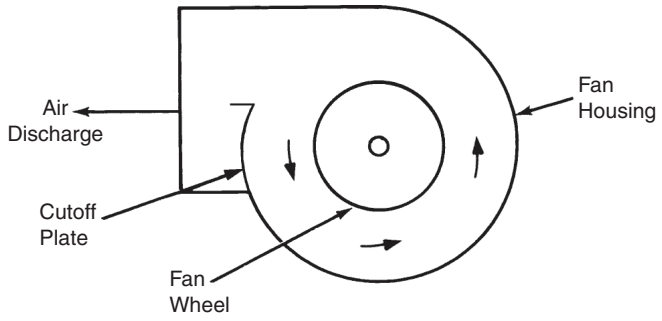


Fig. 34 — Fan Rotation

To reverse the direction of rotation of a 3-phase fan motor, reverse any 2 of the power leads. Refer to the connection diagram on the inside of motor terminal box cover for proper reversing procedure of a single-phase motor.

Fan Pulley Alignment

Align as follows:

1. Loosen setscrews on pulleys.
2. Align pulleys visually and tighten setscrews on fan pulley to lock it in place.
3. Use the methods shown in Fig. 35 to check proper pulley alignment.

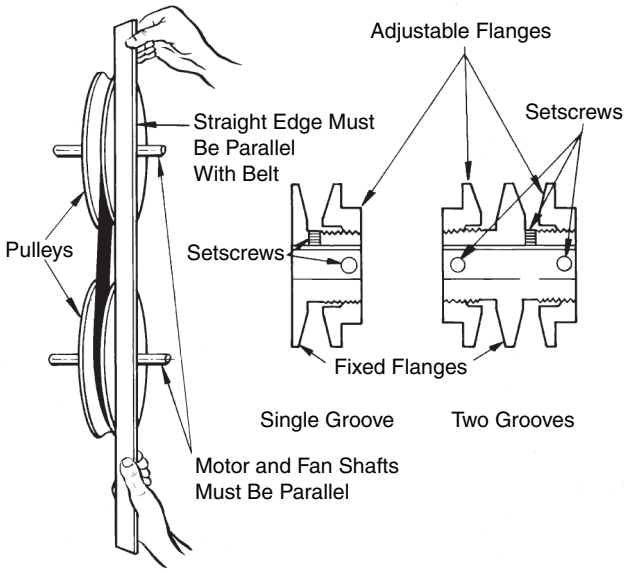


Fig. 35 — Fan Pulley Adjustments

4. If pulleys are not in correct alignment, loosen the motor hold-down bolts and slide the motor axially until the pulleys are aligned.
5. Tighten motor holddown bolts.

Pulley and Drive Adjustment

To obtain desired fan speed, refer to the fan motor, drive data and performance data in Tables 14-27 and adjust fan motor pulley as follows:

1. Remove belt from fan motor pulley after loosening motor from motor base.
2. Loosen setscrew in movable flange of pulley. Screw movable flange toward fixed flange to increase the fan speed and away from fixed flange to reduce speed. Before tightening setscrew, make certain that setscrew is over nearest flat surface of pulley hub. (See Fig. 35.)

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution could cause equipment damage.

Increasing fan speed produces a greater load on motor. Do not exceed rated capacity of motor.

Table 14 — Fan Motor Data, Standard Motor — English

UNIT	40RUA*25 40RUQ*25 40RUS*25	40RUA*28 40RUS*28	40RUA*30 40RUS*30
208/23-3-60 and 460-3-60			
Speed (rpm)	1755	1760	1755
Hp	5.0	7.5	10.0
Frame (NEMA)	184T	S213T	S215T
Shaft Dia (in.)	1-1/8	1-3/8	1-3/8
575-3-60			
Speed (rpm)	1755	1750	1755
Hp	5.0	7.5	10.0
Frame (NEMA)	184T	S213T	S215T
Shaft Dia (in.)	1-1/8	1-3/8	1-3/8

Table 15 — Fan Motor Data, Alternate Motor — English

UNIT	40RUA*25 40RUQ*25 40RUS*25	40RUA*28 40RUS*28	40RUA*30 40RUS*30
208/230-3-60 and 460-3-60			
Speed (rpm)	1760	1755	1755
Hp	7.5	10.0	10.0
Frame (NEMA)	S213T	S215T	S215T
Shaft Dia (in.)	1-3/8	1-3/8	1-3/8
575-3-60			
Speed (rpm)	1750	1755	1755
Hp	7.5	10.0	10.0
Frame (NEMA)	S213T	S215T	S215T
Shaft Dia (in.)	1-3/8	1-3/8	1-3/8

Table 16 — Fan Motor Data, Standard Motor — SI

UNIT	40RUA*25 40RUQ*25 40RUS*25	40RUA*28 40RUS*28	40RUA*30 40RUS*30
208/230-3-60 and 460-3-60			
Speed (r/s)	29.25	29.33	29.25
Shaft kW	3.73	5.59	7.46
Frame (NEMA)	184T	S213T	S215T
Shaft Dia (mm)	28.6	34.9	34.9
575-3-60			
Speed (r/s)	29.25	29.17	29.25
Shaft kW	3.73	5.69	7.46
Frame (NEMA)	184T	S213T	S215T
Shaft Dia (mm)	28.6	34.9	34.9

Table 17 — Fan Motor Data, Alternate Motor — SI

UNIT	40RUA*25 40RUQ*25 40RUS*25	40RUA*28 40RUS*28	40RUA*30 40RUS*30
208/230-3-60 and 460-3-60			
Speed (r/s)	29.33	29.25	29.25
Shaft kW	5.59	7.46	7.46
Frame (NEMA)	S213T	S215T	S215T
Shaft Dia (mm)	34.9	34.9	34.9
575-3-60			
Speed (r/s)	29.17	29.25	29.25
Shaft kW	5.59	7.46	7.46
Frame (NEMA)	S213T	S215T	S215T
Shaft Dia (mm)	34.9	34.9	34.9

LEGEND

NEMA — National Electrical Manufacturers Association

Table 18 — Standard Drive Data, 60 Hz — English

UNIT	40RUA*25 40RUQ*25 40RUS*25	40RUA*28 40RUS*28	40RUA*30 40RUS*30
Motor Drive			
Motor Pulley Pitch Diameter (in.)	3.7-4.7	4.3-5.3	4.3-5.3
Pulley Factory Setting Full Turns Open	3.0	3.0	3.0
Fan Drive			
Pulley Pitch Dia (in.)	9.4	11.0	11.0
Pulley Bore (in.)	1-1/16	1-15/16	1-15/16
Belt No. — Section	1 — B	2 — B[a]	2 — B[a]
Belt Pitch (in.)	41.8	(2) 42.8 (2) 43.8	(2) 42.8 (2) 43.8
Fan Speeds (rpm)			
Factory Setting	771	752	752
Range	679-863	682-841	674-831
Maximum Allowable Speed (rpm)	1200	1100	1100
Change per 1/2 Turn of Movable Motor Pulley Flange	15.3	13.1	13.1
Maximum Full Turn From Closed Position	6	6	6
Shafts Center Distance (in.)	9.12-10.99	6.67-9.43	6.67-9.43

NOTE(S):

a. Four belts shipped with unit. Use correct set of 2 belts sized according to the pulley setting.

Table 19 — Medium-Static Drive Data, 60 Hz — English

UNIT	40RUA*25 40RUQ*25 40RUS*25	40RUA*28 40RUS*28	40RUA*30 40RUS*30
Motor Drive			
Motor Pulley Pitch Diameter (in.)	4.3-5.3	4.3-5.3	4.3-5.3
Pulley Factory Setting Full Turns Open	3.0	3.0	3.0
Fan Drive			
Pulley Pitch Dia (in.)	9.4	9.4	9.4
Pulley Bore (in.)	1-1/16	1-15/16	1-15/16
Belt No. — Section	1 — B	2 — B[a]	2 — B[a]
Belt Pitch (in.)	41.8	2) 38.8 (2) 39.8	2) 38.8 (2) 39.8
Fan Speeds (rpm)			
Factory Setting	881	881	881
Range	798-984	798-984	798-984
Maximum Allowable Speed (rpm)	1200	1100	1100
Change per 1/2 Turn of Movable Motor Pulley Flange	15.3	15.3	15.3
Maximum Full Turn From Closed Position	6	6	6
Shafts Center Distance (in.)	9.16-10.99	6.67-9.43	6.67-9.43

NOTE(S):

a. Four belts shipped with unit. Use correct set of 2 belts sized according to the pulley setting.

Table 20 — High-Static Drive Data, 60 Hz — English

UNIT	40RUA*25 40RUQ*25 40RUS*25	40RUA*28 40RUS*28	40RUA*30 40RUS*30
Motor Drive			
Motor Pulley Pitch Diameter (in.)	4.3-5.3	4.3-5.3	4.3-5.3
Pulley Factory Setting Full Turns Open	3.0	3.0	3.0
Fan Drive			
Pulley Pitch Dia (in.)	7.4	8.6	8.6
Pulley Bore (in.)	1-1/16	1-15/16	1-15/16
Belt No. — Section	2 — B	2 — B	2 — B
Belt Pitch (in.)	36.8	37.8	37.8
Fan Speeds (rpm)			
Factory Setting	1118	1024	1024
Range	1014-1200[a]	873-1075	873-1075
Maximum Allowable Speed (rpm)	1200	1100	1100
Change Per 1/2 Turn of Movable Motor Pulley Flange	19.4	16.7	16.7
Maximum Full Turn From Closed Position	6	6	6
Shafts Center Distance (in.)	8.16-10.02	6.67-9.43	6.67- 9.43

NOTE(S):

a. It is possible to adjust drive so that fan speed exceeds maximum allowable. DO NOT exceed 1200 rpm.

Table 21 — Standard Drive Data, 60 Hz — SI

UNIT	40RUA*25 40RUQ*25 40RUS*25	40RUA*28 40RUS*28	40RUA*30 40RUS*30
Motor Drive			
Motor Pulley Pitch Diameter (mm)	94.0-119.4	109.2-134.6	109.2-134.6
Pulley Factory Setting Full Turns Open	3.0	3.0	3.0
Fan Drive			
Pulley Pitch Dia (mm)	239	279	279
Pulley Bore (mm)	36.5	49.2	49.2
Belt No. — Section	2 — B	2 — B[a]	2 — B[a]
Belt Pitch (mm)	1062	(2) 1987 (2) 1113	(2) 1987 (2) 1113
Fan Speeds (r/s)			
Factory Setting	12.9	12.5	12.5
Range	11.3-14.4	11.4-14.0	11.2-13.9
Maximum Allowable Speed (r/s)	20.0	18.3	18.3
Change Per 1/2 Turn of Movable Motor Pulley Flange	0.255	0.218	0.218
Maximum Full Turn From Closed Position	6	6	6
Shafts Center Distance (mm)	232-279	169-240	169-240

NOTE(S):

a. Four belts shipped with unit. Use correct set of 2 belts sized according to the pulley setting.

Table 22 — Medium-Static Drive Data, 60 Hz — SI

UNIT	40RUA*25 40RUQ*25 40RUS*25	40RUA*28 40RUS*28	40RUA*30 40RUS*30
Motor Drive			
Motor Pulley Pitch Diameter (mm)	109.2-134.6	109.2-134.6	109.2-134.6
Pulley Factory Setting Full Turns Open	3.0	3.0	3.0
Fan Drive			
Pulley Pitch Dia (mm)	239	239	239
Pulley Bore (mm)	36.5	49.2	49.2
Belt No. — Section	1 — B	2 — B[a]	2 — B[a]
Belt Pitch (mm)	1062	(2) 986 (2) 1011	(2) 986 (2) 1011
Fan Speeds (r/s)			
Factory Setting	14.7	14.7	14.7
Range	13.3-16.4	13.3-16.4	11.2-13.9
Maximum Allowable Speed (r/s)	20.0	18.3	18.3
Change Per 1/2 Turn of Movable Motor Pulley Flange	0.255	0.255	0.255
Maximum Full Turn From Closed Position	6	6	6
Shafts Center Distance (mm)	232-279	169-240	169-240

NOTE(S):

a. Four belts shipped with unit. Use correct set of 2 belts sized according to the pulley setting.

Table 23 — High-Static Drive Data, 60 Hz — SI

UNIT	40RUA*25 40RUQ*25 40RUS*25	40RUA*28 40RUS*28	40RUA*30 40RUS*30
Motor Drive			
Motor Pulley Pitch Diameter (mm)	109.2-134.6	109.2-134.6	109.2-134.6
Pulley Factory Setting Full Turns Open	3.0	3.0	3.0
Fan Drive			
Pulley Pitch Dia (mm)	188	203	203
Pulley Bore (mm)	36.5	49.2	49.2
Belt No. — Section	2 — B	2 — B	2 — B
Belt Pitch (mm)	935	935	960
Fan Speeds (r/s)			
Factory Setting	18.6	17.1	17.1
Range	16.9-20.0[a]	14.6-17.9	14.6-17.9
Maximum Allowable Speed (r/s)	20.0	18.3	18.3
Change Per 1/2 Turn of Movable Motor Pulley Flange	0.323	0.278	0.278
Maximum Full Turn From Closed Position	6	6	6
Shafts Center Distance (mm)	207-255	169-240	169-240

NOTE(S):

a. It is possible to adjust drive so that fan speed exceeds maximum allowable. DO NOT exceed 20 r/s.

Table 24 — 40RU Standard Fan Performance Data — 0.0-2.4 in. wg External Static Pressure — English

UNIT[a]	AIRFLOW (cfm)[b]	EXTERNAL STATIC PRESSURE (in. wg)													
		0.0		0.2		0.4		0.6		0.8		1.0		1.2	
		rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
40RUA*25 40RUQ*25[c] 40RUS*25	6,000	532	1.25	569	1.39	639	1.69	711	2.06	781	2.48	846	2.93	905	3.60
	7,000	608	1.93	641	2.09	702	2.42	763	2.08	824	3.23	885	3.71	943	4.23
	8,000	686	2.83	716	3.01	770	3.38	823	3.77	876	4.21	930	4.70	983	5.24
	9,000	764	3.97	791	4.18	841	4.59	888	5.02	935	5.47	982	5.96	1030	6.51
	10,000	843	5.38	868	5.62	914	6.09	957	6.55	1000	7.02	1042	7.53	1084	8.08
40RUA*28 40RUS*28	7,500	456	1.29	490	1.47	556	1.85	621	2.25	678	2.64	729	3.06	778	3.60
	8,750	521	1.98	551	2.18	608	2.61	664	3.07	720	3.53	770	3.99	816	4.45
	10,000	587	2.88	614	3.11	664	3.59	714	4.09	763	4.62	812	5.15	857	5.68
	11,250	653	4.03	678	4.29	724	4.82	768	5.37	812	5.95	856	6.54	899	7.14
	12,500	720	5.46	743	5.75	785	6.33	825	6.93	865	7.55	904	8.20	944	8.86
	15,000	829	8.84	850	9.19	888	9.88	924	10.57	958	11.27	991	11.99	1024	12.73
40RUA*30 40RUS*30	9,000	521	1.99	550	2.25	616	2.77	676	3.23	731	3.72	782	4.20	829	4.70
	10,500	596	3.16	623	3.40	672	3.89	720	4.40	767	4.94	814	5.50	859	6.05
	12,000	673	4.63	698	4.90	743	5.45	785	6.02	826	6.62	867	7.23	908	7.87
	13,500	751	6.51	773	6.82	815	7.44	853	8.06	890	8.71	927	9.38	963	10.07
	15,000	829	8.84	850	9.19	888	9.88	924	10.57	958	11.27	991	11.99	1024	12.73

UNIT[a]	AIRFLOW (cfm)[b]	EXTERNAL STATIC PRESSURE (in. wg)											
		1.4		1.6		1.8		2.0		2.2		2.4	
		rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
40RUA*25 40RUQ*25[c] 40RUS*25	6,000	954	3.83	1005	4.27	1052	4.72	1098	5.22	1142	5.67	—	—
	7,000	990	4.74	1040	5.24	1090	5.80	1135	6.30	1176	6.84	—	—
	8,000	1028	5.79	1078	6.38	1130	7.00	1173	7.60	—	—	—	—
	9,000	1073	7.11	1120	7.72	1169	8.37	—	—	—	—	—	—
	10,000	1126	8.75	1166	9.37	—	—	—	—	—	—	—	—
40RUA*28 40RUS*28	7,500	831	4.41	870	5.10	913	5.90	950	6.88	985	7.70	—	—
	8,750	859	4.97	901	5.59	944	6.42	980	7.20	1020	8.10	—	—
	10,000	900	6.20	939	6.74	976	7.33	1013	8.00	1050	8.82	—	—
	11,250	941	7.73	980	8.32	1017	8.90	1052	9.51	1088	10.16	—	—
	12,500	984	9.53	1022	10.19	1058	10.84	1093	11.49	—	—	—	—
	15,000	1057	13.49	1090	14.28	—	—	—	—	—	—	—	—
40RUA*30 40RUS*30	9,000	866	5.20	899	5.85	950	6.65	989	7.38	1029	8.32	1077	9.74
	10,500	902	6.60	942	7.14	980	7.70	1016	8.31	1051	8.99	1085	9.77
	12,000	949	8.50	988	9.14	1026	9.76	1062	10.38	1095	11.01	—	—
	13,500	1000	10.78	1036	11.49	1073	12.21	—	—	—	—	—	—
	15,000	1057	13.49	1090	14.28	—	—	—	—	—	—	—	—

NOTE(S):

a. Refer to fan motor and drive tables for additional data.
b. Fan performance is based on deductions for wet coil, clean 2-in. filters, and unit casing. See table below for factory-supplied filter pressure drop.
c. Maximum allowable fan speed for size 25 units is 1200 rpm. Maximum allowable fan speed for size 28 and 30 units is 1100 rpm.

Factory-Supplied Pressure Drop — English

UNIT	AIRFLOW (cfm	PRESSURE DROP (in. wg)
40RUA*25 40RUQ*25 40RUS*25	6,000	0.12
	8,000	0.19
	10,000	0.26
40RUA*28 40RUS*28	7,500	0.15
	10,000	0.22
	12,500	0.30
40RUA*30 40RUS*30	9,000	0.19
	12,000	0.29
	15,000	0.40

LEGEND

bhp — Brake Horsepower Input to Fan

Table 25 — 40RU Standard Fan Performance Data — 0-600 kPa External Static Pressure — SI

UNIT[a]	AIRFLOW (L/s)[b]	EXTERNAL STATIC PRESSURE (kPa)													
		0		50		100		150		200		250		300	
		r/s	kW	r/s	kW	r/s	kW	r/s	kW	r/s	kW	r/s	kW	r/s	kW
40RUA*25 40RUQ*25[c] 40RUS*25	2830	8.86	0.94	9.48	1.04	10.65	1.26	11.84	1.53	13.01	1.85	14.10	2.19	15.08	2.53
	3300	10.14	1.44	10.69	1.56	11.70	1.81	12.71	2.08	13.73	2.41	14.74	2.77	15.71	3.15
	3780	11.43	2.11	11.93	2.25	12.84	2.52	13.71	2.81	14.60	3.14	15.49	3.51	16.39	3.91
	4250	12.74	2.96	13.19	3.12	14.02	3.43	14.81	3.74	15.59	4.08	16.37	4.45	17.17	4.85
	4720	14.05	4.01	14.47	4.19	15.23	4.54	15.96	4.88	16.66	5.24	17.36	5.62	18.07	6.03
40RUA*28 40RUS*28	3540	7.60	0.96	8.16	1.09	9.27	1.38	10.34	1.68	11.30	1.97	12.15	2.28	12.97	2.68
	4130	8.68	1.47	9.18	1.62	10.13	1.94	11.07	2.29	11.99	2.63	12.84	2.97	13.60	3.32
	4720	9.78	2.15	10.23	2.32	11.07	2.67	11.89	3.05	12.72	3.45	13.53	3.84	14.29	4.23
	5310	10.89	3.01	11.30	3.20	12.06	3.59	12.80	4.00	13.53	4.43	14.27	4.88	14.99	5.33
	5900	12.00	4.07	12.38	4.29	13.09	4.72	13.75	5.17	14.41	5.63	15.07	6.11	15.74	6.61
40RUA*30 40RUS*30	4250	8.68	1.48	9.17	1.68	10.27	2.07	11.27	2.41	12.19	2.77	13.03	3.13	13.81	3.50
	4960	9.93	2.35	10.38	2.53	11.21	2.90	11.99	3.28	12.78	3.68	13.56	4.10	14.32	4.51
	5660	11.21	3.45	11.63	3.66	12.38	4.07	13.08	4.49	13.76	4.93	14.45	5.39	15.14	5.87
	6370	12.51	4.85	12.89	5.08	13.58	5.54	14.22	6.01	14.83	6.49	15.44	6.99	16.05	7.51
	7080	13.82	6.59	14.17	6.85	14.81	7.36	15.40	7.88	15.97	8.40	16.52	8.94	17.06	9.49

UNIT[a]	AIRFLOW (L/s)[b]	EXTERNAL STATIC PRESSURE (kPa)											
		350		400		450		500		550		600	
		r/s	kW	r/s	kW	r/s	kW	r/s	kW	r/s	kW	r/s	kW
40RUA*25 40RUQ*25[c] 40RUS*25	2830	15.90	2.86	16.75	3.18	17.53	3.52	18.30	3.89	19.03	4.23	—	—
	3300	16.50	3.53	17.33	3.91	18.17	4.32	18.92	4.70	19.60	5.10	—	—
	3780	17.13	4.32	17.97	4.76	18.83	5.22	19.55	5.67	—	—	—	—
	4250	17.88	5.30	18.67	5.76	19.48	6.24	—	—	—	—	—	—
	4720	18.77	6.52	19.43	6.99	—	—	—	—	—	—	—	—
40RUA*28 40RUS*28	3540	13.85	3.29	14.50	3.80	15.22	4.40	15.83	5.13	16.42	5.74	—	—
	4130	14.31	3.71	15.01	4.17	15.74	4.79	16.33	5.37	17.00	6.04	—	—
	4720	14.99	4.62	15.65	5.02	16.27	5.46	16.88	5.97	17.50	6.57	—	—
	5310	15.68	5.77	16.34	6.20	16.95	6.64	17.53	7.09	18.09	7.58	—	—
	5900	16.39	7.10	17.03	7.60	17.64	8.08	18.22	8.57	—	—	—	—
40RUA*30 40RUS*30	4250	14.43	3.88	14.98	4.36	15.84	4.96	16.48	5.50	17.16	6.21	17.96	7.26
	4960	15.04	4.92	15.71	5.32	16.33	5.74	16.93	6.20	17.51	6.70	18.09	7.29
	5660	15.81	6.34	16.47	6.81	17.10	7.28	17.69	7.74	18.26	8.21	—	—
	6370	16.66	8.04	17.27	8.57	17.88	9.10	—	—	—	—	—	—
	7080	17.61	10.06	18.16	10.64	—	—	—	—	—	—	—	—

NOTE(S):

a. Refer to fan motor and drive tables for additional data.
b. Fan performance is based on deductions for wet coil, clean 51mm filters, and unit casing. See table below for factory-supplied filter pressure drop.
c. Maximum allowable fan speed for size 25 units is 20 r/s. Maximum allowable fan speed for size 28 and 30 units is 18.3 r/s.

Factory-Supplied Pressure Drop — SI

UNIT	AIRFLOW (L/s)	PRESSURE DROP (Pa)
40RUA*25 40RUQ*25 40RUS*25	2900	32
	3800	47
	4700	64
40RUA*28 40RUS*28	3500	36
	4700	55
	5900	76
40RUA*30 40RUS*30	4250	47
	5650	71
	7050	98

Table 26 — 40RU High-Capacity Fan Performance Data — 0.0-2.4 in. wg External Static Pressure — English

UNIT[a]	AIRFLOW (cfm)[b]	EXTERNAL STATIC PRESSURE (in. wg)													
		0.0		0.2		0.4		0.6		0.8		1.0		1.2	
		rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
40RUA*25 40RUQ*25[c] 40RUS*25	6,000	542	1.29	577	1042	646	1.72	716	2.09	785	2.51	849	2.95	907	3.40
	7,000	620	1.99	652	2.15	711	2.48	771	2.85	831	3.28	890	3.76	947	4.27
	8,000	700	2.92	728	3.10	781	3.46	833	3.85	885	4.29	938	4.78	990	5.32
	9,000	781	4.10	806	4.30	854	4.71	900	5.13	946	5.58	993	6.08	1039	6.62
40RUA*28 40RUS*28	10,000	862	5.56	885	5.79	929	6.24	971	6.70	1012	7.18	1054	7.69	1096	8.24
	7,500	476	1.39	510	1.58	579	1.99	644	2.40	701	2.81	752	3.29	804	3.96
	8,750	545	2.14	574	2.35	633	2.81	691	3.29	747	3.77	797	4.25	842	4.76
	10,000	615	3.12	641	3.36	692	3.87	743	4.41	794	4.96	843	5.51	888	6.05
	11,250	685	4.37	709	4.64	754	5.20	800	5.79	845	6.40	891	7.02	935	7.64
	12,500	756	5.92	778	6.22	819	6.83	860	7.47	901	8.14	942	8.83	983	9.52
40RUA*30 40RUS*30	9,000	539	2.18	569	2.39	626	2.85	683	3.34	739	3.83	791	4.32	837	4.82
	10,500	620	3.37	646	3.62	695	4.13	744	4.68	793	5.25	842	5.83	888	6.41
	12,000	701	4.94	724	5.22	769	5.80	811	6.40	854	7.04	897	7.69	940	8.36
	13,500	783	6.95	804	7.27	844	7.91	883	8.57	920	9.26	958	9.97	996	10.71
	15,000	865	9.45	884	9.81	921	10.52	956	11.24	991	11.98	1025	12.75	1059	13.54

UNIT[a]	AIRFLOW (cfm)[b]	EXTERNAL STATIC PRESSURE (in. wg)											
		1.4		1.6		1.8		2.0		2.2		2.4	
		rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
40RUA*25 40RUQ*25[c] 40RUS*25	6,000	961	3.86	1011	4.31	1058	4.77	1104	5.24	1147	5.71	—	—
	7,000	1000	4.79	1050	5.32	1097	5.85	1142	6.38	1184	6.91	—	—
	8,000	1041	5.88	1090	6.47	1137	7.07	1181	7.67	—	—	—	—
	9,000	1086	7.21	1133	7.82	1178	8.47	—	—	—	—	—	—
40RUA*28 40RUS*28	10,000	1138	8.83	1180	9.46	—	—	—	—	—	—	—	—
	7,500	874	5.33	897	5.91	940	6.80	990	7.50	—	—	—	—
	8,750	886	5.36	930	6.13	982	7.32	1020	8.10	—	—	—	—
	10,000	930	6.60	969	7.20	1007	7.89	1045	8.71	—	—	—	—
	11,250	976	8.25	1014	8.86	1051	9.49	1086	10.17	—	—	—	—
	12,500	1023	10.20	1061	10.88	1097	11.56	—	—	—	—	—	—
40RUA*30 40RUS*30	9,000	881	5.37	923	6.03	967	6.89	1020	8.25	—	—	—	—
	10,500	930	6.97	970	7.55	1008	8.17	1045	8.86	—	—	—	—
	12,000	981	9.02	1021	9.67	1058	10.32	1094	10.97	—	—	—	—
	13,500	1035	11.45	1072	12.20	—	—	—	—	—	—	—	—
	15,000	1093	14.35	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Refer to fan motor and drive tables for additional data.
b. Fan performance is based on deductions for wet coil, clean 2-in. filters, and unit casing. See table below for factory-supplied filter pressure drop.
c. Maximum allowable fan speed for size 25 units is 1200 rpm. Maximum allowable fan speed for size 28 and 30 units is 1100 rpm.

Factory-Supplied Pressure Drop — English

UNIT	AIRFLOW (cfm)	PRESSURE DROP (in. wg)
40RUA*25 40RUQ*25 40RUS*25	6,000	0.12
	8,000	0.19
	10,000	0.26
40RUA*28 40RUS*28	7,500	0.15
	10,000	0.22
	12,500	0.30
40RUA*30 40RUS*30	9,000	0.19
	12,000	0.29
	15,000	0.40

LEGEND

bhp — Brake Horsepower Input to Fan

Table 27 — 40RU High-Capacity Fan Performance Data — 0-600 kPa External Static Pressure — SI

UNIT[a]	AIRFLOW (L/s)[b]	EXTERNAL STATIC PRESSURE (kPa)													
		0		50		100		150		200		250		300	
		r/s	kW	r/s	kW	r/s	kW	r/s	kW	r/s	kW	r/s	kW	r/s	kW
40RUA*25 40RUQ*25[c] 40RUS*25	2830	9.03	0.96	9.62	1.06	10.77	1.29	11.94	1.56	13.08	1087	14.15	2.20	15.12	2.54
	3330	10.34	1.48	10.86	1.60	11.85	1.85	12.84	2.12	13.85	2.45	14.84	2.80	15.78	3.18
	3780	11.67	2.17	12.14	2.31	13.02	2.58	13.88	2.87	14.75	3.20	15.63	3.56	16.50	3.96
	4250	13.01	3.05	13.44	3.21	14.23	3.51	15.00	3.82	15.77	4.16	16.54	4.53	17.32	4.94
	4720	14.36	4.15	14.75	4.32	15.48	4.66	16.18	4.99	16.87	5.35	17.56	5.73	18.26	6.14
40RUA*28 40RUS*28	3540	7.94	1.04	8.51	1.18	9.65	1.48	10.73	1.79	11.68	2.10	12.53	2.46	13.40	2.95
	4130	9.08	1.59	9.57	1.75	10.55	2.10	11.52	2.46	12.45	2.81	13.28	3.17	14.04	3.55
	4720	10.24	2.33	10.68	2.51	11.53	2.88	12.39	3.29	13.24	3.70	14.05	4.11	14.80	4.51
	5310	11.42	3.26	11.81	3.46	12.57	3.88	13.33	4.32	14.09	4.77	14.85	5.24	15.58	570
	5900	12.60	4.42	12.96	4.64	13.65	5.09	14.33	5.57	15.01	6.07	15.40	6.58	16.38	7.10
40RUA*30 40RUS*30	4250	8.99	1.62	9.49	1.78	10.44	2.12	11.39	2.49	12.32	2.86	13.18	3.22	13.95	3.59
	4960	10.33	2.51	10.77	2.70	11.59	3.08	12.40	3.49	13.22	3.92	14.03	4.35	14.79	4.78
	5660	11.68	3.68	12.07	3.90	12.81	4.33	13.52	4.77	14.23	5.25	14.95	5.74	15.66	6.23
	6370	13.04	5.18	13.40	5.42	14.07	5.90	14.71	6.39	15.34	6.90	15.97	7.44	16.61	7.98
	7080	14.42	7.05	14.74	7.31	15.36	7.84	15.94	8.38	16.51	8.93	17.08	9.51	17.65	10.10

UNIT[a]	AIRFLOW (L/s)[b]	EXTERNAL STATIC PRESSURE (kPa)											
		350		400		450		500		550		600	
		r/s	kW	r/s	kW	r/s	kW	r/s	kW	r/s	kW	r/s	kW
40RUA*25 40RUQ*25[c] 40RUS*25	2830	16.01	2.88	16.85	3.22	17.64	3.56	18.39	3.91	19.12	4.26	—	—
	3300	16.67	3.57	17.50	3.96	18.28	4.36	19.03	4.75	19.73	5.15	—	—
	3780	17.35	4.39	18.17	4.82	18.95	5.27	19.68	5.72	—	—	—	—
	4250	18.11	5.37	18.88	5.83	19.63	6.31	—	—	—	—	—	—
	4720	18.96	6.58	19.67	7.05	—	—	—	—	—	—	—	—
40RUA*28 40RUS*28	3540	14.57	3.97	14.95	4.41	15.67	5.07	16.50	5.59	—	—	—	—
	4130	14.76	3.99	15.51	4.57	16.36	5.46	17.00	6.04	—	—	—	—
	4720	15.49	4.92	16.15	5.37	16.78	5.88	17.42	6.50	—	—	—	—
	5310	16.26	6.15	16.91	6.61	17.51	7.08	18.10	7.58	—	—	—	—
	5900	17.04	7.61	17.68	8.11	18.28	8.62	—	—	—	—	—	—
40RUA*30 40RUS*30	4250	14.68	4.00	15.38	4.49	16.12	5.14	17.00	6.15	—	—	—	—
	4960	15.51	5.20	16.17	5.63	16.80	6.09	17.41	6.61	—	—	—	—
	5660	16.35	6.72	17.01	7.21	17.64	7.69	18.23	8.18	—	—	—	—
	6370	17.24	8.54	17.87	9.10	—	—	—	—	—	—	—	—
	7080	18.22	10.70	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Refer to fan motor and drive tables for additional data.
b. Fan performance is based on deductions for wet coil, clean 51 mm filters, and unit casing. See table below for factory-supplied filter pressure drop.
c. Maximum allowable fan speed for size 25 units is 20 r/s. Maximum allowable fan speed for size 28 and 30 units is 18.3 r/s.

Factory-Supplied Pressure Drop — SI

UNIT	AIRFLOW (L/s)	PRESSURE DROP (Pa)
40RUA*25 40RUQ*25 40RUS*25	2900	32
	3800	47
	4700	64
40RUA*28 40RUS*28	3500	36
	4700	55
	5900	76
40RUA*30 40RUS*30	4250	47
	5650	71
	7050	98

Variable Frequency Drive

The VFD switches the indoor fan motor speed between full/high speed (60 Hz motor operation) and reduced/low speed (40 Hz motor operation), as required by ASHRAE 90.1-2016 and IECC-2015 requirements for two-stage HVAC units. The VFD is factory-configured to match the current and power requirements for each motor selection and all wiring connections are completed by the factory; no field adjustments or connections are necessary.

While the basic VFD retains all of its standard capabilities, the SAV 2-speed application uses only a limited portion of these features to provide a 0-10 VDC input based on thermostat demand to the VFD to control the motor speed. With a ventilation or low cooling demand, the Unit Control Board will provide a VDC input corresponding to 66% of design airflow. With a high cooling or heating demand, the Unit Control Board will provide a VDC input corresponding to 100% of design airflow. The fan control signal is based on control board settings (potentiometer and DIP switches) that are factory-set and thermostat demand to the UCB. While the pulley and drive should be adjusted to obtain desired airflow, the potentiometer on the UCB can be used to fine-tune the airflow setting when the fan is running in high speed (see Operating Fan for Test and Balance and Fan Speed Set-Up sections).

The VFD is not equipped with a keypad. A keypad is used for ACS320 and ACH550 drives only; it is available as an accessory (P/N CRDISKIT001A00) for field-installation or expanded service access to VFD parameter and troubleshooting tables. See Tables 28-29 for terminal designations and Fig. 36-37 for wiring. See Appendix A for VFD parameters.

The VFD used in the SAV™ system has soft start capabilities to slowly ramp up speeds, eliminating any high in-rush of air volume during speed changes. It also has internal overcurrent protection for the fan motor.

Table 28 — ACS320 VFD Terminal Designations

TERMINAL	FUNCTION
U1 V1 W1	Three-Phase main circuit input power supply
U2 V2 W2	Three-Phase AC output to motor, 0V to maximum input voltage level
2 (AI1) 3 (GND)	Analog input (0-10V)
4	10 VDC Reference Voltage
10 (GND) 11 (COMMON)	Factory-supplied jumper
9 (24 VDC) 12 (DI-1)	Activate to start drive (Start/Stop)
17 (Relay COM) 19 (Relay NO)	Relay Output for Unit Control Board safety chain

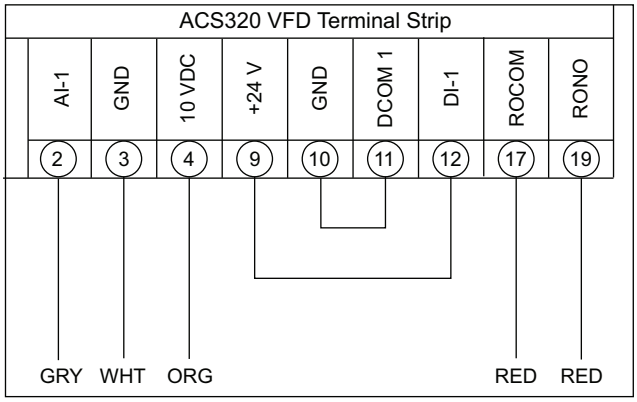


Fig. 36 — ACS320 VFD Wiring

Table 29 — ACH550 VFD Terminal Designations

TERMINAL	FUNCTION
U1 V1 W1	Three-Phase main circuit input power supply
U2 V2 W2	Three-Phase AC output to motor, 0V to maximum input voltage level
2 (AI2) 3 (GND)	Analog input (0-10V)
4	10 VDC Reference Voltage
11 (GND) 12 (COMMON)	Factory-supplied jumper
10 (24 VDC) 13 (DI-1)	Activate to start drive (Start/Stop)
25 (Relay 3 COM) 27 (Relay 3 NO)	Relay Output for Unit Control Board safety chain

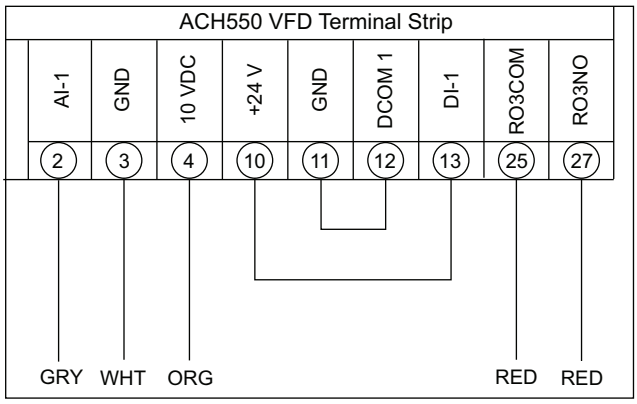


Fig. 37 — ACH550 VFD Wiring

INDOOR FAN MOTOR

The indoor fan motors used with the VFD are specially manufactured for use with VFD power circuits. The motor winding insulation is specially formulated to resist breakdown due to voltage stress issues. The motor shaft includes grounding rings to prevent damage to bearings caused by grounding currents. Replace these motors with Factory Authorized Parts available from Replacement Components Division (RCD).

VFD FUSES

Table 30 details the fuse requirement for the VFD installed in 40RU units. Check the control wiring diagram label on the specific unit in use for the fuse location.

FAN FAULT DETECTION:

The Variable Frequency Drive is equipped with a relay internal to the drive that is used to prevent the motor from running if there are faults detected by the VFD. If the 40RU is connected to the condensing unit correctly (refer to Power Supply and Wiring section), then the Unit Control Board will also prevent the thermostat signals from being sent to the condensing unit, preventing compressor(s) from energizing if there is a VFD fault or if the VFD is de-energized.

VFD ALARMS AND FAULTS TROUBLESHOOTING

The VFD has two LEDs (light-emitting diodes) on its front panel that indicate VFD operating status. These LEDs are GREEN and RED.

- GREEN LED ON STEADY: Power ON to VFD
- GREEN LED FLASHING: Alarm condition detected
- RED LED ON (Steady or Flashing): Fault condition detected

ALARMS

Alarms are advisory in nature. These indicate a problem has been detected by the VFD's diagnostics but this problem will not require that the VFD and its motor be shut down. Typical fault condition on the SAV™ application might be loose connections at the VFD terminal board or damaged conductors between the Fan Speed Board connector J2 and the VFD terminal strip. See Table 31 for a full list.

CLEAR THE ALARM LED

Shut off power to the VFD for five minutes. Restore power and recheck the GREEN LED. If this LED is still flashing, then connect the accessory remote display keypad kit. Use Table 31 to determine if the alarm requires any corrective action (action is not always required) and address the root cause of the problem.

If diagnostics troubleshooting has determined that the drive is defective during the warranty period, contact Carrier.

FAULTS

A fault is a significant internal situation for the VFD or its motor. If the motor was running when the fault was detected, it was shutdown. See Table 32 for a full list of faults, display codes, and recommended actions.

Clear the Fault LED

The recommended corrective action for faults is shown in Table 32. The VFD can also be reset to remove the fault. If an external source for a start command is selected and is active, the VFD may start immediately after fault reset.

Connect the accessory remote display keypad kit. To reset a fault indicated by a flashing red LED, turn off the power for 5 minutes. To reset a fault indicated by a red LED (not flashing), press RESET from the control panel or turn off the power for 5 minutes. Depending on the value of parameter 1604 (FAULT RESET SELECT), digital input or serial communication could also be used to reset the drive. When the fault has been corrected, the motor can be started.

Table 30 — VFD Fuse Requirements, 40RU Units

UNIT	HP	VOLTAGE	VFD	MOTOR	STANDARIZED FUSE	FUSE P/N	HARNESS WIRE GAUGE[a]
40RU	5	208/230	HK30WA524	HD60FK659	30A - CLASS CC KTK	HY10KB300	10
		460	HK30WA532	HD60FK659	30A - CLASS CC KTK	HY10KB300	10
		575	HK30WA362	HD60FK577	15A - CLASS CC KTK	HY10KB151	10
	7.5	208/230	HK30WA523	HD62FK654	60A - CLASS J	HY10JK060	10
		460	HK30WA532	HD62FK654	30A - CLASS CC KTK	HY10KB300	10
		575	HK30WA362	HD62FL576	15A - CLASS CC KTK	HY10KB151	10
	10	208/230	HK30WA525	HD64FK654	60A - CLASS J	HY10JK060	10
		460	HK30WA533	HD64FK654	30A - CLASS CC KTK	HY10KB300	10
		575	HK30WA363	HD64FL576	15A - CLASS CC KTK	HY10KB151	10

NOTE(S):

a. Harness wire gauge between control box and VFD.

Table 31 — Alarm Codes

ALARM CODE	ALARM NAME IN PANEL	DESCRIPTION AND RECOMMENDED CORRECTIVE ACTION
2001	—	Reserved
2002	—	Reserved
2003	—	Reserved
2004	DIR LOCK	The change in direction being attempted is not allowed. Do not attempt to change the direction of motor rotation, or Change parameter 1003 DIRECTION to allow direction change (if reverse operation is safe).
2005	I/O COMM	Field bus communication has timed out. Check fault setup (3018 COMM FAULT FUNC and 3019 COMM FAULT TIME). Check communication settings (Group 51 or 53 as appropriate). Check for poor connections and/or noise on line.
2006	AI1 LOSS	Analog input 1 is lost, or value is less than the minimum setting. Check input source and connections. Check the parameter that sets the minimum (3021) and the parameter that sets the Alarm/Fault operation (3001).
2007	AI2 LOSS	Analog input 2 is lost, or value is less than the minimum setting. Check input source and connections. Check parameter that sets the minimum (3022) and the parameter that sets the Alarm/Fault operation (3001).
2008	PANEL LOSS	Panel communication is lost and either the VFD is in local control mode (the control panel displays HAND), or the VFD is in remote control mode (AUTO) and is parameterized to accept start/stop, direction or reference from the control panel. To correct, check the communication lines and connections, Parameter 3002 PANEL LOSS, and parameters in groups 10 COMMAND INPUTS and 11 REFERENCE SELECT (if drive operation is REM).
2009	—	Reserved
2010	MOT OVERTEMP	Motor is hot, based on either the VFD estimate or on temperature feedback. This alarm warns that a Motor Overload fault trip may be near. Check for overloaded motor. Adjust the parameters used for the estimate (3005-3009). Check the temperature sensors and Group 35 parameters.
2011	UNDERLOAD	Motor load is lower than expected. This alarm warns that a Motor Underload fault trip may be near. Check that the motor and drive ratings match (motor is NOT undersized for the drive). Check the settings on parameters 3013 to 3015.
2012	MOTOR STALL	Motor is operating in the stall region. This alarm warns that a Motor Stall fault trip may be near.
2013*	AUTORESET	This alarm warns that the drive is about to perform an automatic fault reset, which may start the motor. To control automatic reset, use parameter group 31 (AUTOMATIC RESET).
2014	AUTOCHANGE	This alarm warns that the PFA autochange function is active. To control PFA, use parameter group 81 (PFA) and the Pump Alternation macro.
2015	PFA INTERLOCK	This alarm warns that the PFA interlocks are active, which means that the drive cannot start any motor (when Autochange is used), or a speed regulated motor (when Autochange is not used).
2016	—	Reserved
2017*	OFF BUTTON	This alarm indicates that the OFF button has been pressed.
2018	PID SLEEP	This alarm warns that the PID sleep function is active, which means that the motor could accelerate when the PID sleep function ends. To control PID sleep, use parameters 4022-4026 or 4122-4126.
2019	ID RUN	The VFD is performing an ID run.
2020	OVERRIDE	Override mode is activated.
2021	START ENABLE 1 MISSING	This alarm warns that the Start Enable 1 signal is missing. To control Start Enable 1 function, use parameter 1608. To correct, check the digital input configuration and the communication settings.
2022	START ENABLE 2 MISSING	This alarm warns that the Start Enable 2 signal is missing. To control Start Enable 2 function, use parameter 1609. To correct, check the digital input configuration and the communication settings.
2023	EMERGENCY STOP	Emergency stop is activated.

Table 32 — Fault Codes

FAULT CODE	FAULT NAME IN PANEL	DESCRIPTION AND RECOMMENDED CORRECTIVE ACTION
1	OVERCURRENT	Output current is excessive. Check for excessive motor load, insufficient acceleration time (parameters 2202 ACCELER TIME 1, default 30 seconds), or faulty motor, motor cables or connections.
2	DC OVERVOLT	Intermediate circuit DC voltage is excessive. Check for static or transient over voltages in the input power supply, insufficient deceleration time (parameters 2203 DECELER TIME 1, default 30 seconds), or undersized brake chopper (if present).
3	DEV OVERTEMP	Drive heat sink is overheated. Temperature is at or above 115°C (239°F). Check for fan failure, obstructions in the air flow, dirt or dust coating on the heat sink, excessive ambient temperature, or excessive motor load.
4	SHORT CIRC	Fault current. Check for short-circuit in the motor cable(s) or motor or supply disturbances.
5	OVERLOAD	Inverter overload condition. The drive output current exceeds the ratings.
6	DC OVERVOLT	Intermediate circuit DC voltage is not sufficient. Check for missing phase in the input power supply, blown fuse, or under voltage on main circuit.
7	AI1 LOSS	Analog input 1 loss. Analog input value is less than AI1 FLT LIMIT (3021). Check source and connection for analog input and parameter settings for AI1 FLT LIMIT (3021) and 3001 AI<MIN FUNCTION.
8	AI2 LOSS	Analog input 2 loss. Analog input value is less than AI2 FLT LIMIT (3022). Check source and connection for analog input and parameter settings for AI2 FLT LIMIT (3022) and 3001 AI<MIN FUNCTION.
9	MOT OVERTEMP	Motor is too hot, as estimated by the drive. Check for overloaded motor. Adjust the parameters used for the estimate (3005-3009). Check the temperature sensors and Group 35 parameters.
10	PANEL LOSS	Panel communication is lost and either drive is in local control mode (the control panel displays LOC), or drive is in remote control mode (REM) and is parameterized to accept start/stop, direction or reference from the control panel. To correct check the communication lines and connections. Check parameter 3002 PANEL COMM ERROR, parameters in Group 10: Command Inputs and Group 11:Reference Select (if drive operation is REM).
11	ID RUN FAIL	The motor ID run was not completed successfully. Check motor connections.
12	MOTOR STALL	Motor or process stall. Motor is operating in the stall region. Check for excessive load or insufficient motor power. Check parameters 3010-3012.
13	RESERVED	Not used.
14	EXT FAULT 1	Digital input defined to report first external fault is active. See parameter 3003 EXTERNAL FAULT 1.
15	EXT FAULT 2	Digital input defined to report second external fault is active. See parameter 3004 EXTERNAL FAULT 2.
16	EARTH FAULT	The load on the input power system is out of balance. Check for faults in the motor or motor cable. Verify that motor cable does not exceed maximum specified length.
17	UNDERLOAD	Motor load is lower than expected. Check for disconnected load. Check parameters 3013 UNDERLOAD FUNCTION through 3015 UNDERLOAD CURVE.
18	THERM FAIL	Internal fault. The thermistor measuring the internal temperature of the drive is open or shorted. Contact Carrier.
19	OPEX LINK	Internal fault. A communication-related problem has been detected between the OMIO and OINT boards. Contact Carrier.
20	OPEX PWR	Internal fault. Low voltage condition detected on the OINT board. Contact Carrier.

VFD MAINTENANCE

If installed in an appropriate environment, the VFD requires very little maintenance.

Table 33 lists the routine maintenance intervals recommended by Carrier.

Table 33 — Maintenance Intervals

MAINTENANCE	INTERVAL
Heat sink temperature check and cleaning	Every 6 to 12 months (depending on the dustiness of the environment)
HVAC control panel battery change	Every ten years

HEAT SINK CLEANING

The heat sink fins accumulate dust from the cooling air. In a normal environment check, the heat sink annually. In a dusty environment, check more often.

Use the following procedure to clean the heat sink on ASC320 VFDs:

1. Turn off and lock out unit power.
2. Insert a small straight blade screwdriver into the slot and press in to release the top cover as shown in Fig. 38.

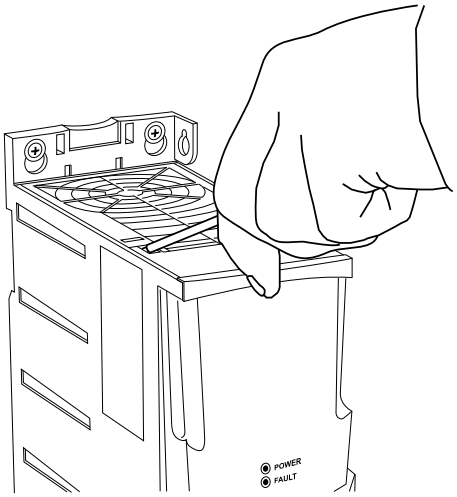


Fig. 38 — Remove Top Cover on ACS320 VFD

3. Blow clean compressed air (not humid) from top of ACS320 while simultaneously using a vacuum cleaner at the base to trap the dust.
4. Replace the top cover.

Restore power.

Use the following procedure to clean the heat sink on AHC550 VFDs:

1. Turn off and lock out unit power.
2. Remove the drive cover (see Fig. 39).
3. Press together the retaining clips on the top cover and lift (see Fig. 40).

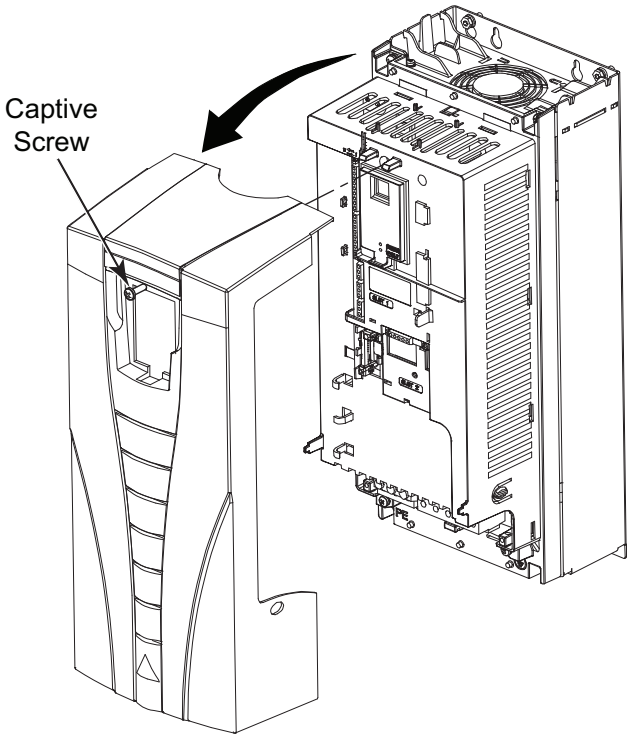


Fig. 39 — Remove ACH550 VFD Front Cover

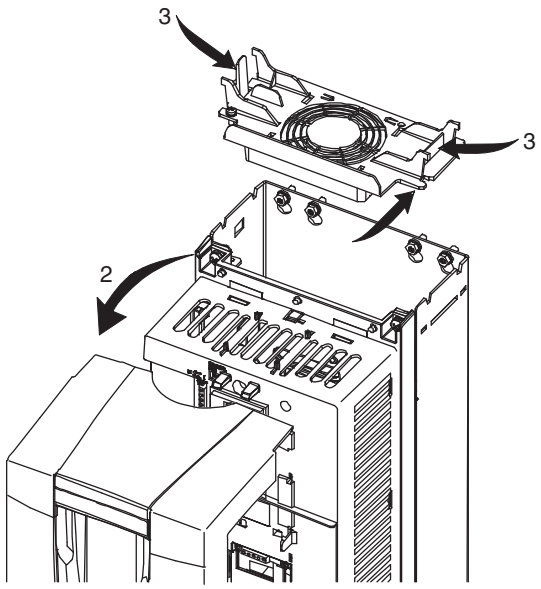


Fig. 40 — Remove Top Cover on ACH550 VFD

4. Blow clean compressed air (not humid) from bottom to top while simultaneously using a vacuum cleaner at the air outlet to trap the dust.
5. Replace the cooling fan.
6. Replace the drive cover.
7. Restore power.

Bypass the VFD

⚠ WARNING

Bypassing the VFD is not recommended. This is a temporary procedure to provide cooling or heating operation when a new VFD is required. When in this bypass mode the fire shut down will not turn off the blower and it will continue to run. The bypass should only be used for a short duration until a new VFD has been received.

The factory-installed VFD is wired and agency approved as outlined in this manual. This VFD is utilized to help provide added efficiencies and comfort during the cooling operation.

If there is an occasion where the VFD has malfunctioned and temporary cooling/operation is required, bypass the VFD as shown in Fig. 41.

To bypass VFD:

1. Turn off and lock out unit power.
2. Disconnect the connector linking the fuse to the VFD.
3. Disconnect the connector between the VFD and the indoor fan motor.
4. Disconnect the ground wires at the base of the VFD.
5. Remove the VFD, if required.
6. Connect the lead from the fuse to the lead from the indoor fan motor.
7. Connect the ground wire from the indoor fan motor to the fan deck.
8. Restore power.

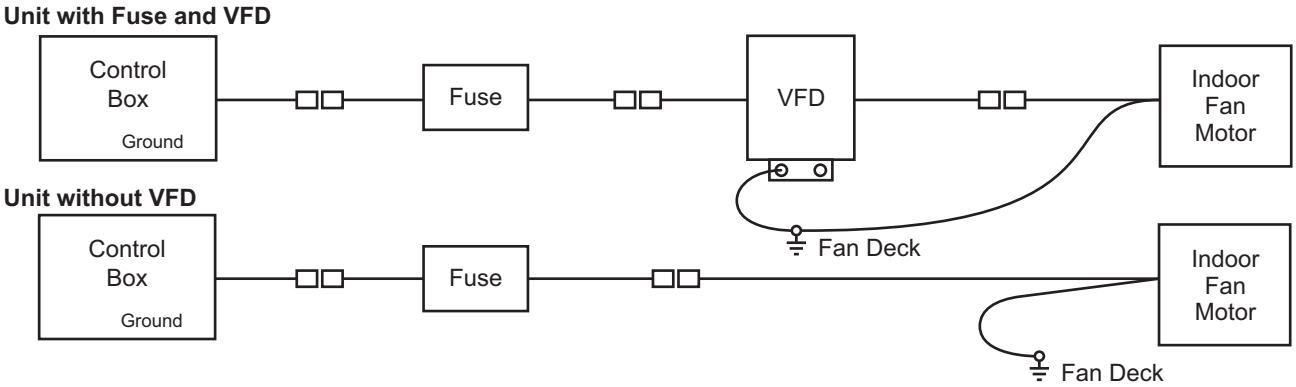


Fig. 41 — To Bypass VFD

Condensate Drains

Keep condensate drains free of dirt and foreign matter.

Return-Air Filters

Refer to Replacing Filters section for filter accessibility and removal. Replace with clean filters of the sizes listed in Tables 1-6.

Chilled Water Coil Freeze Protection

Shut off water supply to unit. Remove side panel of unit and remove vent and drain plugs in top and bottom of coil header. Drain coil and blow out remaining water. Reinstall plugs and side panel. Alternative freeze protection methods follow:

- Circulate hot water within the water coil's supply main or supplementary space heating.
- Close off supply lines to unit and open a union or field-supplied drain valve in the return line.

IMPORTANT: Draining from return line will not completely drain water from coils.

- After draining as much water as possible from coils, add sufficient antifreeze to prevent residual water in the coil from freezing.
- Add a sufficient quantity of non-corrosive antifreeze to the entire system to prevent all water within the system from freezing.

Coil Removal

Remove unit panels and corner posts as required. Disconnect coil connections and remove fastening screws. Remove coil through end or side sections of unit.

Cleaning Cooling Coil

Remove return-air filters. Remove any heavy dirt that may have accumulated on underside of coil. Coil can be cleaned more easily with a stiff brush, vacuum cleaner, or compressed air when coil is dry. If coil is wet or if water is to be used for cleaning, guard against splashing water on electrical components or damaging surrounding area. Clean coil baffles as applicable and check for tight fit to be sure air does not bypass coil.

Cleaning Insulation

The insulation contains an immobilized antimicrobial agent that helps inhibit the growth of bacteria and fungi. Clean the inner surface of the insulation according to the separate maintenance instructions shipped with the unit.

Replacing Filters

Filters can be removed and installed from either side of the unit. Install new filters in units that have one fan as follows:

1. Remove the side access panel (retain screws).
2. Remove the filter retainer clip (see Fig. 42).
3. Remove old filters by lifting and tilting them out of the filter track. (See Fig. 16 and 43.) Use the factory-supplied filter hook to slide filters within reach for removal. The filter hook is shipped inside the unit in the filter track.
4. Reverse the procedure to install new filters.

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution could cause equipment damage.

Do not operate unit without air filters.

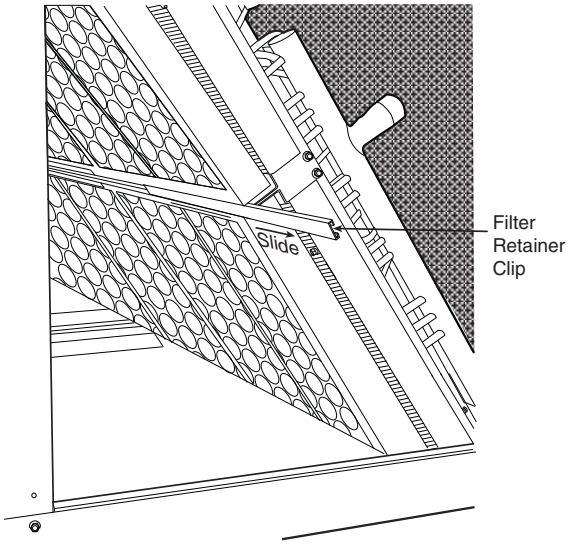


Fig. 42 — Remove Filter Retainer Clip

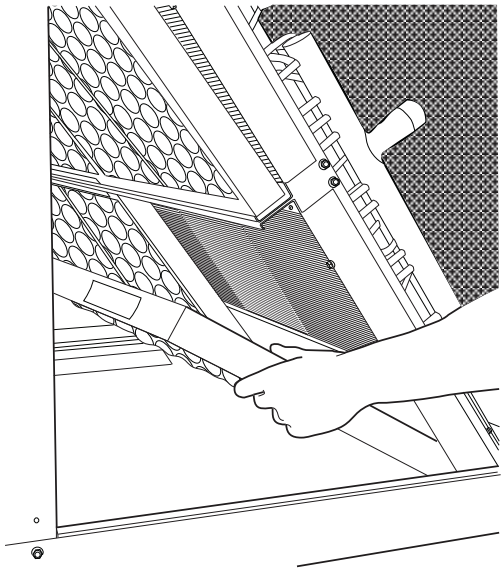


Fig. 43 — Filter Removal/Replacement

APPENDIX A — VFD PARAMETERS

Table A — ACS320 Common Parameters

PARAMETERS	DESCRIPTION	SETTING ACS320
9802	COMM Prot Sel	—
9907	Motor Nominal Frequency	60Hz
1001	EXT1 Commands	DI1
1102	EXT1/EXT2 Sel	EXT1
1103	REF1 Select	AI-1
1201	Const Speed Sel	DI 2, 3
1202	Const Speed 1	40Hz
1203	Const Speed 2	60Hz
1204	Const Speed 3	60Hz
1205	Const Speed 4	—
1301	Minimum AI1	0.02
1401	Relay Output 1	FAULT (-1)
1403	Relay Output 3	—
1501	AO1 Content Sel	—
1601	Run Enable	—
1608	Start Enable 1	Not Sel
1611	Parameter View	3
2007	Minimum Frequency	0.0 Hz
2008	Maximum Frequency	60Hz
2101	Start FCN	Auto
2102	Stop FCN	Coast
2201	Accel/Decel	Not Sel
2202	Accel	30s
2203	DECEL	30s
2603	IR COMP Volt	0
2606	Switching Frequency	4kHz
3102	Trial Time	300.0s
3103	Delay Time	6.0s
3104	AR Overcurrent	Enable
5101	FBA Type	—
5201	Station ID	—
5202	Baud Rate	—
5203	Parity	—
5301	EFB Protocol ID	—
5302	EFB Station ID	—
5303	EFB Baud Rate	—
5304	EFB Parity	—
5305	EFB CTRL Profile	—

Table B — ACH550 VFD Common Parameters

PARAMETERS	DESCRIPTION	SETTING ACH550
9802	COMM Prot Sel	—
9902	Application Macro	—
9907	Motor Nominal Frequency	60Hz
1001	EXT1 Commands	DI1
1102	EXT1/EXT2 Sel	EXT1
1103	REF1 Select	AI-1
1201	Const Speed Sel	DI 2, 3
1202	Const Speed 1	40Hz
1203	Const Speed 2	60Hz
1204	Const Speed 3	60Hz
1205	Const Speed 4	—
1301	Minimum AI1	2%
1401	Relay Output 1	—
1403	Relay Output 3	FAULT (-1)
1501	AO1 Content Sel	—
1601	Run Enable	—
1608	Start Enable 1	Not Sel
2007	Minimum Frequency	0.0 Hz
2008	Maximum Frequency	60Hz
2101	Start FCN	Auto
2102	Stop FCN	Ramp
2201	Accel/Decel	Not Sel
2202	Accel	30s
2203	DECEL	30s
2606	Switching Frequency	4kHz
3102	Trial Time	300.0s
3103	Delay Time	6.0s
3104	AR Overcurrent	Enable
5101	FBA Type	—
5201	Station ID	—
5202	Baud Rate	—
5203	Parity	—
5301	EFB Protocol ID	—
5302	EFB Station ID	—
5303	EFB Baud Rate	—
5304	EFB Parity	—
5305	EFB CTRL Profile	—

APPENDIX A — VFD PARAMETERS (cont)

Table C — ACS320 VFD Parameters

VFD PARAMETERS	PKG ABB ACS320	MOTOR PART NO.	VFD PART NO.	DRIVE HP	DESC.	VOLTAGE (9905)	N. AMPS (9906)	MOTOR NOM FREQ (Hz) (9907)	N. RPM (9908)	N. HP (9909)	MAX AMPS (2003)	CROSS REFERENCE EM_PKG
40RU000516-DATA	40RU000516	HD60FK657	HK30WA532	7	40RU 5.0 HP 460V	460	7.6	60	1760	5.0	8.7	40RU000516
40RU000517-DATA	40RU000517	HD60FK657	HK30WA524	7	40RU 5.0 HP 230V	230	17.0	60	1760	5.0	19.6	40RU000517
40RU000591-DATA	40RU000591	HD62FK654	HK30WA524	7	40RU 7.5 HP 230V	230	21.5	60	1760	7.5	24.7	40RU000591
40RU000592-DATA	40RU000592	HD62FK654	HK30WA532	7	40RU 7.5 HP 460V	460	14.3	60	1760	7.5	16.4	40RU000592
40RU000594-DATA	40RU000594	HD64FK654	HK30WA525	10	40RU 10 HP 230V	230	28 6	60	1755	10.0	32.2	40RU000594
40RU000595-DATA	40RU000595	HD64FK654	HK30WA533	10	40RU 10 HP 460V	460	15.2	60	1755	10.0	17.5	40RU000595

Table D — ACH550 VFD Parameters

VFD PARAMETERS	PKG ABB ACS550	MOTOR PART NO.	VFD PART NO.	DRIVE HP	DESC.	VOLTAGE (9905)	N. AMPS (9906)	MOTOR NOM FREQ (Hz) (9907)	N. RPM (9908)	N. HP (9909)	MAX AMPS (2003)	CROSS REFERENCE EM_PKG
40RU000515-DATA	40RU000515	HD60FK577	HK30WA362	7.5	40RU 5.0 HP 575V	575	8.0	60	1745	5.0	9.2	40RU000515
40RU000590-DATA	40RU000590	HD62FL576	HK30WA362	7.5	40RU 7.5 HP 575V	575	9.0	60	1750	7.5	10.4	40RU000590
40RU000593-DATA	40RU000593	HD64FL576	HK30WA363	10.0	40RU 10 HP 575V	575	11.0	60	1755	10.0	12.7	40RU000593

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

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START-UP CHECKLIST

(SPLIT SYSTEMS WITH 40RU UNITS)

NOTE: To avoid injury to personnel and damage to equipment or property when completing the procedures listed in this start-up checklist, use good judgment, follow safe practices, and adhere to the safety considerations/information as outlined in preceding sections of this Installation, Start-Up, and Service document.

I. PRELIMINARY INFORMATION

OUTDOOR: MODEL NO. _____ INDOOR: MODEL NO. _____

SERIAL NO._____ SERIAL NO. _____

ADDITIONAL ACCESSORIES _____

II. PRE-START-UP

OUTDOOR UNIT

IS THERE ANY SHIPPING DAMAGE? (Y/N)_____

IF SO,
WHERE:_____

_____

WILL THIS DAMAGE PREVENT UNIT START–UP? (Y/N)_____

CHECK POWER SUPPLY. DOES IT AGREE WITH UNIT? (Y/N)_____

HAS THE GROUND WIRE BEEN CONNECTED? (Y/N)_____

VERIFY GROUND INTEGRITY WITH CONTINUITY TEST (Y/N)_____

HAS THE CIRCUIT PROTECTION BEEN SIZED AND INSTALLED PROPERLY? (Y/N)_____

ARE THE POWER WIRES TO THE UNIT SIZED AND INSTALLED PROPERLY? (Y/N)_____

HAVE COMPRESSOR HOLDDOWN BOLTS BEEN LOOSENED? (Y/N)_____

CONTROLS

ARE THERMOSTAT(S) AND INDOOR FAN CONTROL WIRING CONNECTIONS MADE AND CHECKED? (Y/N)_____

ARE ALL WIRING TERMINALS (including main power supply) TIGHT? (Y/N)_____

HAVE OUTDOOR UNIT CRANKCASE HEATERS BEEN ENERGIZED FOR 24 HOURS? (Y/N)_____

INDOOR UNIT

HAS WATER BEEN PLACED IN DRAIN PAN TO CONFIRM PROPER DRAINAGE? (Y/N)_____

ARE PROPER AIR FILTERS IN PLACE? (Y/N)_____

HAVE FAN AND MOTOR PULLEYS BEEN CHECKED FOR PROPER ALIGNMENT? (Y/N)_____

DO THE FAN BELTS HAVE PROPER TENSION? (Y/N)_____

PIPING

40RUA, 40RUQ

HAS FOAM SHIPPING BLOCK BEEN REMOVED FROM THE TXV (Thermostatic Expansion Valve)? (Y/N)_____

ARE LIQUID LINE SOLENOID VALVES LOCATED AT THE INDOOR UNIT (40RUA) OR OUTDOOR UINT (40RUQ) COILS AS REQUIRED? (Y/N)_____

HAVE LEAK CHECKS BEEN MADE AT COMPRESSORS, CONDENSERS, INDOOR COILS, TXVs (Thermostatic Expansion Valves) SOLENOID VALVES, FILTER DRIERS, AND FUSIBLE PLUGS WITH A LEAK DETECTOR? (Y/N)_____

LOCATE, REPAIR, AND REPORT ANY LEAKS. _____

HAVE ALL COMPRESSOR SERVICE VALVES BEEN FULLY OPENED (BACKSEATED)? (Y/N)_____

ARE THE COMPRESSOR OIL SIGHT GLASSES SHOWING CORRECT LEVELS? (Y/N)_____

40RUS

HAS AIR BEEN BLED FROM SYSTEM? (Y/N)_____

HAVE LEAK CHECKS BEEN MADE AT COMPRESSORS, CHILLERS, VALVES, AND INDOOR COILS? (Y/N)_____

LOCATE, REPAIR, AND REPORT ANY LEAKS _____

CHECK VOLTAGE IMBALANCE

LINE-TO-LINE VOLTS: AB_____ V AC_____ V BC_____ V

(AB + AC + BC)/3 = AVERAGE VOLTAGE =_____ V

MAXIMUM DEVIATION FROM AVERAGE VOLTAGE = _____V

VOLTAGE IMBALANCE = 100 X (MAX DEVIATION)/(AVERAGE VOLTAGE) =_____

IF OVER 2% VOLTAGE IMBALANCE, DO NOT ATTEMPT TO START SYSTEM!

CALL LOCAL POWER COMPANY FOR ASSISTANCE.

III. START– UP

CHECK INDOOR FAN MOTOR SPEED AND RECORD.

AFTER AT LEAST 10 MINUTES RUNNING TIME, RECORD THE FOLLOWING MEASUREMENTS:

	COMP A1	COMP B1
OIL PRESSURE	_____	_____
SUCTION PRESSURE	_____	_____
SUCTION LINE TEMP	_____	_____
DISCHARGE PRESSURE	_____	_____
DISCHARGE LINE TEMP	_____	_____
ENTERING OUTDOOR UNIT AIR TEMP	_____	_____
LEAVING OUTDOOR UNIT AIR TEMP	_____	_____
INDOOR UNIT ENTERING AIR DB TEMP	_____	_____
INDOOR UNIT ENTERING AIR WB TEMP	_____	_____
INDOOR UNIT LEAVING AIR DB TEMP	_____	_____
INDOOR UNIT LEAVING AIR WB TEMP	_____	_____
OUTDOOR UNIT ENTERING WATER TEMP (40RUS ONLY)	_____	_____
OUTDOOR UNIT LEAVING WATER TEMP (40RUS ONLY)	_____	_____
INDOOR UNIT ENTERING WATER TEMP (40RUS ONLY)	_____	_____
INDOOR UNIT LEAVING WATER TEMP (40RUS ONLY)	_____	_____
COMPRESSOR AMPS (L1/L2/L3)	____/____/____	____/____/____

CHECK THE COMPRESSOR OIL LEVEL SIGHT GLASSES, ARE THE SIGHT GLASSES SHOWING OIL LEVEL AT 1/8 to 1/3 FULL? (Y/N)_____

NOTES:

_____

_____

_____

_____

_____

_____

CUT ALONG DOTTED LINE

CUT ALONG DOTTED LINE